NXL UPS Module 500/800kVA

User Manual

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Emerson Network Power provides customers with technical support. Users may contact the nearest Emerson local sales office or service center, and can also contact company headquarter.

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Important Notes

This manual is about the installation and operation of Emerson HIPULSE-NXL 500/800kVA UPS Module. Please carefully read this manual prior to installation.

The UPS cannot be put into operation until it is commissioned by the manufacturer or authorized engineer. Otherwise, the damage of UPS will not belong to the warranty scope.

HIPULSE-NXL 500/800kVA UPS is only used for commercial / industrial purpose and cannot be used as life support equipment.

This manual describes the following parts

Equipment	Model
500kVA UPS (12-pulse)	Liebert HIPULSE-NXL 500kVA
800kVA UPS (12-pulse)	Liebert HIPULSE-NXL 800kVA
Optional parts	Model
500kVA Trap filter (50Hz)	
800kVA Trap filter (50Hz)	-
Bypass load sharing inductor	-
Dust filter	-
D-level SPD box	-
BCB box	UF-BCB-NXL 500kVA
BCB cabinet	UF-BCB-NXL 800kVA
SNMP card	UF-SNMP810
Battery temperature sensor	UF-BTS-NXL
Battery grounding fault detecting device	UF-BGFD-NXL 500kVA
Battery grounding fault detecting device	UF-BGFD-NXL 800kVA
Input dry contact board	UF-ICI-NXL
Programmable relay board	UF-PRB-NXL

Safety Precautions

CONFORMITY AND STANDARDS

This equipment complies with the following UPS standards:

- IEC60950-1, IEC62040-1-1— 'General and safety requirements for use in operator access area
- IEC/EN62040-2 EMC requirements
- IEC62040-3'Performance requirements and test methods'

Continued compliance requires installation in accordance with these instructions and the use of manufacturer approved accessories only.

WARNING

High earth leakage current: Earth connection is critical before connecting the input supply (include both utility supply and battery).
This equipment must be earthed in accordance with local electrical codes.

WARNING

Upstream power distribution protection device of the UPS must be selected according to local electrical codes.

WARNING

If any internal fuse of the UPS is damaged, it must be replaced by professionals with a new one of the same specifications.

Caution

This equipment is fitted with EMC filters.

Earth leakage current is between 3.5mA and 3000mA.
Transient and steady-state earth leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous residual current circuit breaker (RCCB) or residual current detector (RCD) devices.
RCCBs must be selected insensitive to DC unidirectional pulses (Class A) and transient current pulses.
Be sure to select the RCCB that is not sensitive to single-direction DC pulse (A level) and transient current pulse.

Note also that the earth leakage currents of the load will be carried by this RCCB or RCD

WARNING

This system has a control signal available for use with an automatic device, externally located, to protect against backfeeding voltage through the mains Static Bypass circuit. If this protection is not used with the switchgear that is used to isolate the bypass circuit, a label must be added at the switchgear to advise service personnel that the circuit is connected to a UPS system.

The text is the following or equivalent: Isolate the UPS before working on the circuit of this UPS.

WARNING

When this product is used in the commercial and industrial applications in the category 2 environment, the installation limits or relevant methods should be used to suppress the disturbance.

General

As with other types of high power equipment, dangerous voltages are present within the UPS and BCB box. However, the risk of contact with these high voltages is minimized as the live component parts are housed behind a hinged, lockable door. Further internal safety screens make the equipment protected to IP20 standards.
No risk exists to any personnel when operating the equipment in the normal manner, following the recommended operating procedures in this manual.
All equipment maintenance and servicing procedures involve internal access and should be carried out only by trained personnel.

Batteries

Battery manufacturers supply details of the necessary precautions to be observed when working on, or in the vicinity of, a large bank of battery cells. These precautions should be followed implicitly at all times. Particular attention should be paid to the recommendations concerning local environmental conditions and the provision of protective clothing, first aid and fire-fighting facilities.

The warning triangle indicates all the personal safety instructions.

Contents

1. General Description

This chapter briefly introduces the features, design philosophy and operation mode of the HIPULSE-NXL 500/800kVA UPS.

Features

The HIPULSE-NXL 500/800kVA UPS is connected between a critical load, such as a computer, and its 3-phase mains power supply to provide high quality 3-phase output power supply. The system offers the user the following advantages:

increased power quality

The UPS has its own internal voltage and frequency regulators which ensure that its output is immune to voltage and frequency variations on the mains power lines.

increased noise rejection

By rectifying the input AC power to DC power, and then converting it back to AC power, any electrical noise present on the input mains supply line is effectively isolated from the UPS output, therefore the critical load sees only clean power.

power blackout protection

If the mains power fails, the UPS continues to power the critical load from its battery, leaving the load immune from power disturbances.

Design Philosophy

System Design

This section describes the operating principle of HIPULSE-NXL 500/800kVA UPS single module. The HIPULSE-NXL UPS basically operates as an AC-DC-AC converter (see Figure 1-1). The first conversion stage (from AC to DC) uses a 3-phase, fully controlled silicon-controlled resistor (SCR) bridge rectifier to convert the incoming mains supply into a regulated DC bus.

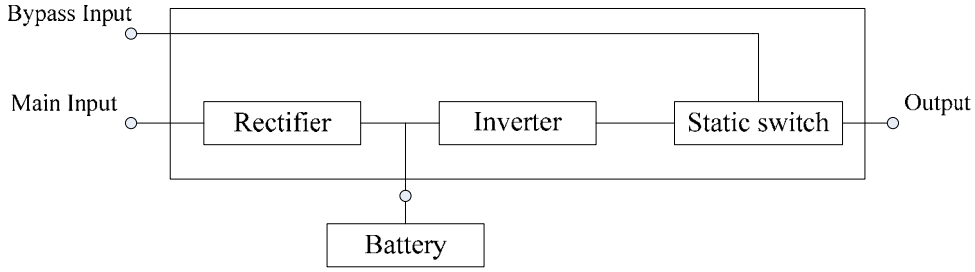


Fig.1- 1 Single module block diagram

The rectifier provides battery charging power – using advanced temperature compensated battery technology, to prolong battery life. The inverter uses the latest large capacity integrated gate bipolar transistor (IGBT) and space vector pulse width modulation (SVPWM) control circuit to reconvert the DC bus voltage back into an AC voltage waveform.

During normal operation, both the rectifier and inverter sections are active and provide regulated load power whilst simultaneously charging the battery. In the event of a mains power failure, the rectifier becomes inoperative and the inverter is powered solely from the battery. Critical load power is maintained under these conditions until the battery is discharged below EOD voltage, whereupon the UPS shuts down (if bypass is normal, the system transfers to bypass mode). The end of battery discharge has been preset. The period for which the load can be maintained following a

mains power failure is known as the system's "Autonomy Time", and this time is dependent upon both the battery A/Hr capacity and the applied percentage load.

Bypass Supplies

Through the intelligent control of "Static switch" in Figure 1-2 that contains an electronically controlled switching circuit, the topology enables the critical load to be connected either to the inverter output or to a bypass supply. During normal operation, the load is connected to the inverter, and the inverter-side of the static switch is turned on. But in the event of a UPS overload (overload time is out) or inverter failure, the "Static switch" module automatically transfers the load to the bypass.

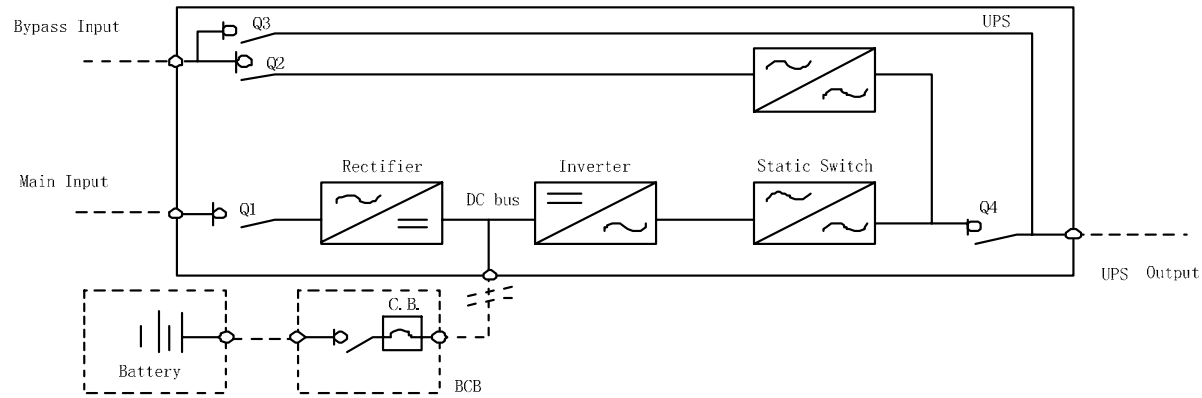


Fig.1- 2 UPS power switches configuration

To provide an uninterrupted load transfer between the inverter and bypass, the inverter output and bypass supply must be fully synchronized during normal operation.

To achieve this, the inverter control circuit makes the inverter output frequency track to the bypass，provided that the bypass remains within an acceptable frequency window.

A manually maintenance bypass switch is also incorporated into the HIPULSE-NXL 500/800kVA UPS design. Its purpose is to enable the critical load to be powered from the maintenance bypass while the UPS is shut down for routine maintenance.

Note: The power supply quality of load equipment is not ensured when load on bypass side or maintenance bypass.

System Control Principles

Normal operation

During normal operation, that is, when the UPS input supply is present and within nominal window, both the rectifier and inverter sections are active and the inverter powers the critical load. The battery circuit breaker (BCB) is also closed and the battery is therefore permanently float charged at the DC bus voltage level.

Mains input failure

If the mains power is interrupted or is out of nominal window, the rectifier will turn off automatically, while the inverter will continue to operate from the battery for a period of time which depends on the load and the capacity of the battery. If the mains supply has not returned within this time untill the battery voltage drops to the end of discharge voltage, the inverter will turn off automatically and an alarm message will appear on the operator and display panel of the UPS.

Return of mains power

When the mains returns within the required time limit, the rectifier will start up again automatically and its output power increases gradually, supplying power to the inverter and recharging the battery at the same time. There will be no interruption of the critical load.

Battery disconnection

If the battery system needs to be taken out of service for maintenance, it can be disconnected by means of (an) external disconnect breaker (s). The UPS shall continue to function and meet all of the specified steady-state performance criteria, except for storage mode.

UPS single module fault

In the event of an inverter fault, the load will be automatically transferred to the bypass without interruption. In such an event, please seek technical assistance from Emerson local customer service center.

Overload

In the event of an overload at the inverter output which lasts longer than the specified nominal time/current (refer to table 8-6), the load will be automatically transferred to the bypass without interruption. If the actual load falls within the specified nominal time/current, the load will be returned to the inverters. In the event of a short circuit in the output, the load will normally be transferred to the bypass, and the inverter will shut down. This transfer is determined by the features of the protective devices used in the system.

In both above cases, an alarm message will appear on the operator and display panel of the UPS.

Maintenance bypass

A second bypass circuit contained in the UPS cabinet, identified as the maintenance bypass, is included to provide an unprocessed mains supply to the load while facilitating a safe working environment for carrying out scheduled UPS system maintenance or trouble shooting. This circuit is manually selected by the maintenance bypass switch, and it is disconnected when it is in the OFF position.

WARNING

Do not use the internal maintenance bypass when the UPS system is comprised of more than two UPS modules in parallel.
CAUTION: If an automatic circuit breaking device is not present in the input distribution panel, there remains a dangerously high voltage at the output busbars and also on the input busbars of the UPS module that is switched off.

UPS Power Switch Configuration

Figure 1-2 illustrates the block diagram of HIPULSE-NXL UPS module in what is known as the distributed bypass configuration (that is, the bypass uses independent mains power input). In the distribued bypass configuration, the static bypass and maintenance bypass shares one independent bypass power source. When the UPS is in normal operation, all the other switches except maintenance bypass switch Q3 should be closed.

Battery Circuit Breaker

The battery should be connected to the DC bus bar through a battery circuit breaker. The battery circuit breaker is a standard optional part that should be located adjacent to the batteries. This circuit breaker is closed manually, but it contains an undervoltage release coil which enables it to be tripped when receiving a trip signal from the UPS control electronics following certain detected DC bus under voltage faults.

Battery Temperature Compensation

HIPULSE-NXL 500/800kVA UPS system offers a battery temperature compensation function. As the battery ambient temperature rises, the DC bus voltage reduces in order to sustain the battery at its optimum charge voltage (charges the battery). This must be used in conjunction with the battery temperature sensing device. The battery temperature measurement sensor is a standard battery temperature detecting component.

Operation Mode

The UPS has the following operating modes:

Normal mode

The mains power is firstly rectified through the UPS rectifier, and is then inverted by an inverter that continuously supplies the load. In the meantime, the rectifier/charger perform float or equalize charging to backup battery.

Battery mode

In battery mode, the critical AC load is supplied by the inverter, which obtains power from the battery. There is no interruption in power to the load upon failure of the AC mains input power because the UPS will transfer to battery mode automatically. When the AC mains input power is restored, the system will return to the Normal mode operation automatically, and the power to the load will not be interrupted.

Auto-restart mode

The UPS provides the auto-restart function. That is: The battery becomes exhausted following a prolonged AC mains failure. The inverter shuts down when the battery reduced to the end-of-discharge voltage. When the mains power returns, the UPS can be programmed to Auto restart after a set variable delay time. This mode and any delay time of auto-restart can be configured by the commissioning engineer authorized by Emerson.

Bypass mode

The load power is supplied by the mains power of static bypass. This mode can be considered as an intermediate operating condition which is for the load transfer between inverter and maintenance bypass or a power supply mode under abnormal operating conditions.

Maintenance mode

The UPS is shut down but the load is connected to the mains power of through the maintenance bypass switch.

Load Sharing mode

Due to the Load sharing mode, the UPS has the capability of fully supporting its load while limiting the amount of power taken from the incoming AC mains supply. Any balance of power required is supplied by the UPS battery. This feature is useful in applications where peak-hour tariffs apply or where a generator that has smaller capacity than needed powers the UPS during mains-power outages. The Load sharing mode is user-activated and the ratio of the mains AC input power is programmable from 50% to 125% of the rated UPS output power.

2. Mechanical Installation

This chapter briefly introduces the mechanical installation of the HIPULSE-NXL 500/800kVA UPS, including the cautions, environmental and mechanical requirements for installation, inspections before installation and installation drawings.

Cautions


WARNING

Do not apply electrical power to the UPS equipment before the commissioning engineer arrives at installation site.


WARNING

The UPS should be installed by a qualified engineer in accordance with the information contained in this chapter. All equipment this manual not referred is shipped with details of its own mechanical and electrical installation information.


WARNING: battery hazards

Special care should be taken when installing the batteries. When connecting the battery, the battery terminal voltage will exceed 540Vdc and is potentially lethal.

1. Eye protection should be worn to prevent injury from accidental electrical arcs.
2. Remove rings , watches and all metal objects.
3. Only use tools with insulated handles.
4. Wear rubber gloves.
5. If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations.
6. If electrolyte comes into contact with the skin, the affected area should be washed immediately with water.


WARNING

The UPS system can be connected to a power system whose neutral point is not earthed (that is an IT system).

This chapter describes the environmental and mechanical requirements that must be taken into account when positioning and cabling the UPS equipment.

Because every site has its peculiarities, this chapter does not provide step-by-step installation instructions, but to provide generic installation procedures and practices that should be observed by the installing engineer according to actual site conditions.

Environmental Requirements

UPS Positioning

The UPS module should be located in a cool, dry, clean-air environment with adequate ventilation to keep the environmental parameters within the specified operating range (see Table 8-2 environmental conditions).

The HIPULSE-NXL 500/800kVA UPS uses forced convection cooling by internal fans. Cooling air enters the module through ventilation grills located at various parts of the cabinet and exhausted through grills located in the cabinet roof. When the UPS cabinet is installed on a raised floor, and bottom cable entry is used, additional cooling air also enters the UPS through the floor void. If necessary, a system of extractor fans should be installed to aid cooling-air flow, and air filters are used where the UPS is to operate in a dirty environment.

Note 1: When battery cabinet is mounted adjacent to the UPS, it is the battery which dictates the designed maximum ambient temperature, not the UPS.

Note 2: The UPS should be installed on a cement surface or other surface that is not combustible.

Note 3: Since the UPS has a greater power loss when it operates in inverter mode, the cooling capacity of air conditioner should be selected according to the power loss in inverter mode. Refer to table 7-8 Electrical performance (system performance)

Battery Positioning

Ambient temperature is a major factor in determining the battery capacity and life. The nominal operating temperature of battery is 20°C. Operating above this temperature will reduce the battery life, and operation below this temperature will reduce the battery capacity. In a normal installation the battery temperature is maintained between 15°C and 25°C. Batteries should be mounted in an environment where the temperature is constant stable. Keep batteries away from main heat sources or main air outlets.

The batteries can be mounted in specific battery cabinet, which is positioned adjacent to the UPS module. Brackets are needed for the batteries when they are located on raised floors, in the same way as for the UPS cabinets. If the batteries are rack-mounted, or otherwise located remote to the UPS cabinet, the battery circuit breakers must be mounted as close as possible to the batteries, and the connecting cables should be as short as possible. The battery interface board (BIB) and the battery circuit breaker (BCB) should be placed inside the BCB box.

Mechanical Requirements

Components of System

A UPS system can comprise a number of cabinets such as UPS cabinet and battery cabinet, depending on the specific system design requirements. The 500kVA UPS cabinet comprises 2 cabinets which are a rectifier cabinet and an inverter cabinet. The 800kVA UPS cabinet comprises 3 cabinets which are a rectifier cabinet, an inverter cabinet and a switch cabinet. In general, all the cabinets used in the same installation site are of the same height and should be positioned side-by-side to achieve an aesthetically appealing effect.

Transporting The Cabinets

WARNING

1. Ensure that any lifting equipment that used in moving the UPS cabinet has sufficient lifting capacity.
2. Do not lift the cabinet in installation.

Ensure that the UPS weight is within the weight loading capacity range of any hoisting equipment. See Table 8-3 for UPS weight.

The UPS cabinet can be moved by a forklift. Before moving the UPS cabinet, it is necessary to remove both the front, rear (or side) grille panels located at the base of the cabinet.

Clearances Required For Operating

As HIPULSE-NXL 500/800kVA UPS has no ventilation grills at either the sides or the rear, no clearances are required for the side and rear sides. However, where space permits, a clearance of approximately 600mm at the back will ease access to magnetic component parts. Clearance around the front of the equipment should be sufficient to enable free passage of personnel with the doors fully opened.

Removing Transportation Rubber Bar and Restraints

In order to avoid the friction between the internal doors of the cabinet during transportation, some rubber bars are mounted between the internal doors before the delivery of the UPS. After the UPS has arrived at the customer site, these rubber bars need to be removed.

Before the UPS is put in place, remove the transportation restraints that hold the input and output transformers in place. For procedures, refer to *Appendix 1 Transportation Restraints Removing Procedures.*

Cable Entry Method

The HIPULSE-NXL500/800kVA UPS can use either the top cabling or bottom cabling mode.

Top cabling can be made by removing cover boards of the rectifier cabinet and switch cabinet to expose the installation holes of copper busbars.

Bottom cabling can be made by removing left cover boards at the bottom of the rectifier cabinet to expose the installation holes of copper buss, and the installation holes of copper buses are visible if you remove the right cover board at the bottom of the inverter cabinet (switch cabinet of 800kVA). For bottom cabling, the cables should enter from the rear side of the rectifier cabinet and inverter cabinet.

Note: When selecting the power cables for bottom entry to a UPS, consideration must be given to the minimum permissible radius of the proposed cables and proper routing of the cables so as to ensure that they can be orderly connected the UPS connection copper bars.

Mechanical Connection Between Cabinets

The HIPULSE-NXL 500/800kVA UPS is composed of multi cabinets and the mechanical connections between the cabinets are needed to fix the cabinets and avoid the movement of the cabinets due to mechanical vibration. Moreover, the mechanical connection can ensure the reliable grounding of the cabinets.

As shown in Figure 2-1, the HIPULSE-NXL 500kVA UPS comprises of the rectifier cabinet and the inverter cabinet. The cabinets should be connected by bolts mounted at location A (upper) and location B (lower) in the front part of the cabinet. The corresponding upper and lower locations on the rear part of the cabinet should also be connected via bolts. The bolts used in these four locations in the front and rear part should be identical and each location should use 2 bolts, that is, the connection between the cabinets should use 15 PCS M10×30 bolts, M10 plain washer and M10 spring washers each. The recommended tightening torque for M10 bolt and nut is 35Nm.

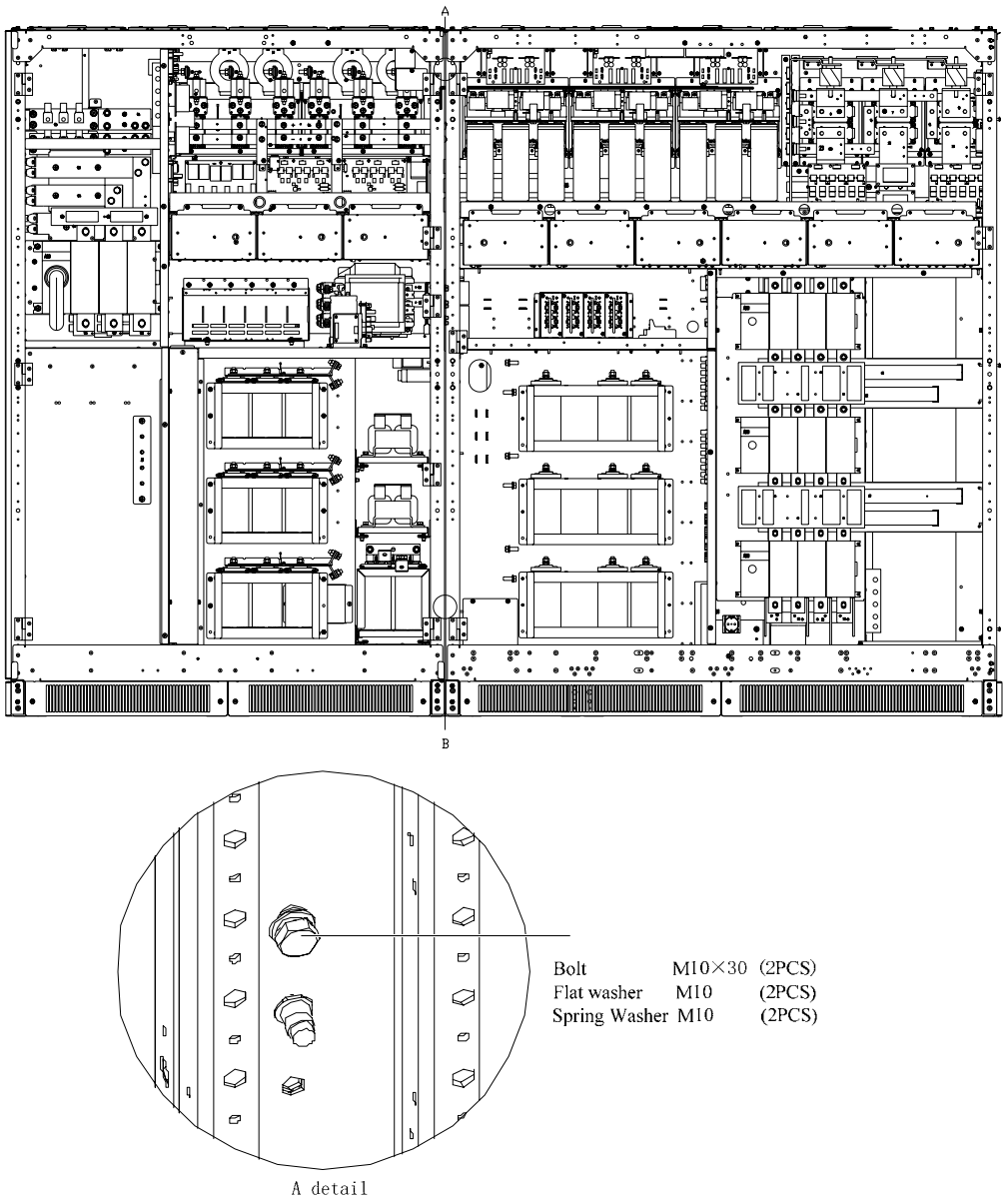


Fig.2- 1 Mechanical connections between 500kVA UPS cabinets

As shown in Figure 2-2, the HIPULSE-NXL 800kVA UPS is composed of three cabinets that are the rectifier cabinet, the inverter cabinet and the switch cabinet. The cabinets should be connected by bolts mounted at the locations A, B, C and D in the front part of the cabinet. The bolts mounted at locations A, C and D should be identical and each location should be mounted with 2 bolts. The location B should be mounted with 1 bolt. The corresponding locations A, B, C and D in the rear part of the cabinet should be also mounted with the identical bolts to connect the cabinets. Each location should be mounted with 2 bolts. Therefore, the mechanical connection between the cabinets need 15 PCS M10×30 bolts, M10 plain washer and M10 spring washer each. The recommended tightening torque for M10 bolt and nut is 35Nm.

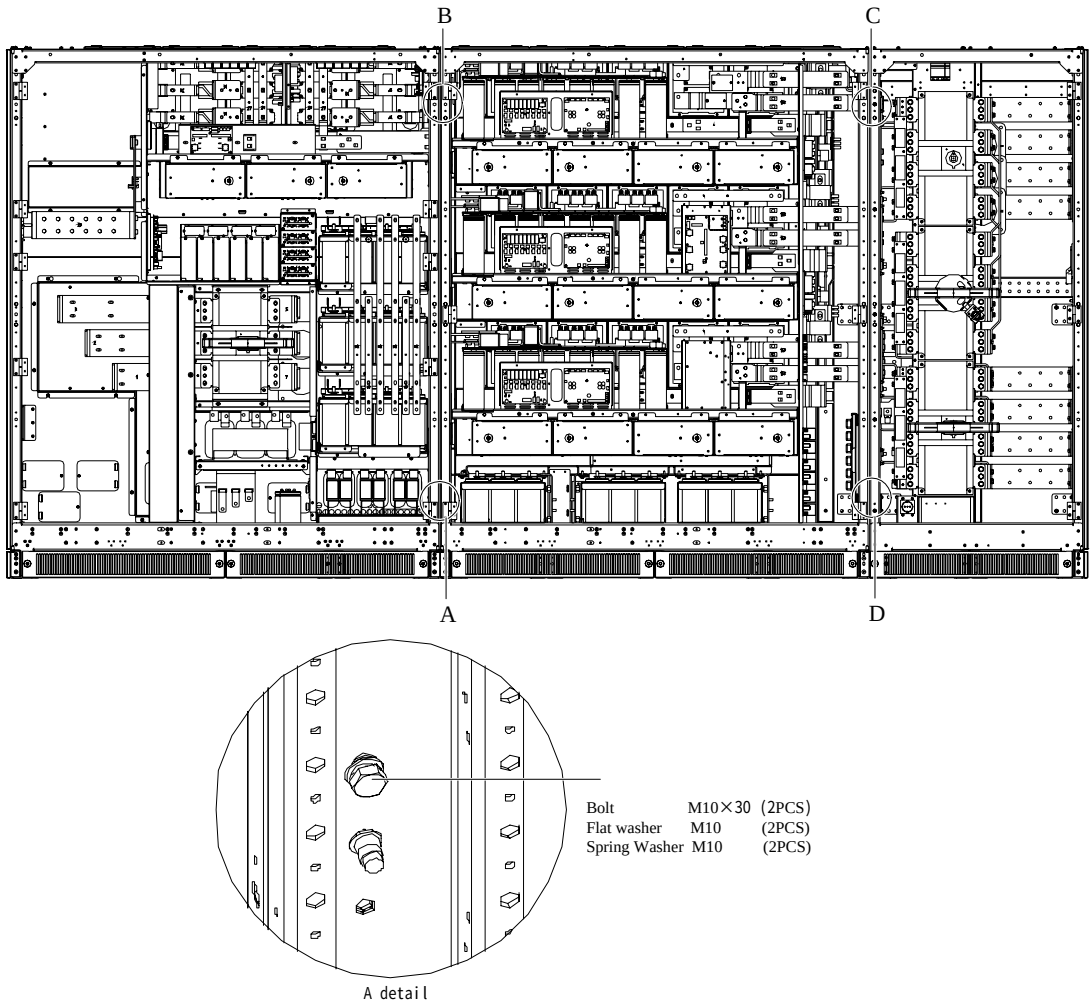


Fig.2- 2 Mechanical connections between 800kVA UPS cabinets

Preliminary Inspection

Carry out the following preliminary inspections before you install the UPS:

1. Verify that the UPS room satisfies the environmental conditions stipulated in the equipment specification, paying particular attention to the ambient temperature, ventilation conditions, and dust density.

2. Remove the packages of the UPS and batteries, visually examine if there is any damage inside and outside the UPS and battery equipment due to the transportation. Report any such damage to the shipper immediately.

Installation Drawings

The following drawings of Figure 2-3 and Figure 2-4 illustrate the key mechanical characteristics of the HIPULSE-NXL 500/ 800kVA UPS cabinets.

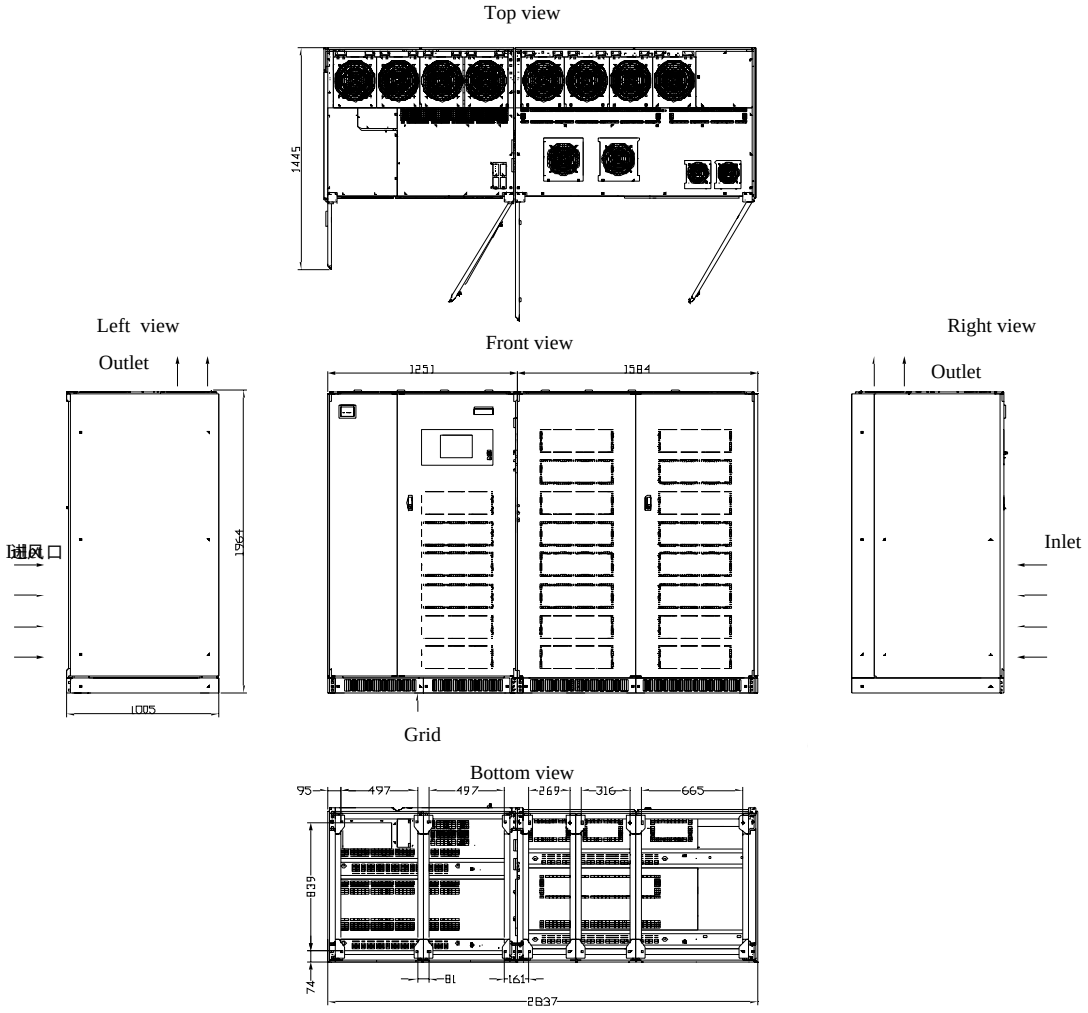


Fig.2- 3 Top, front, side and bottom views of 500kVA UPS (unit in mm)

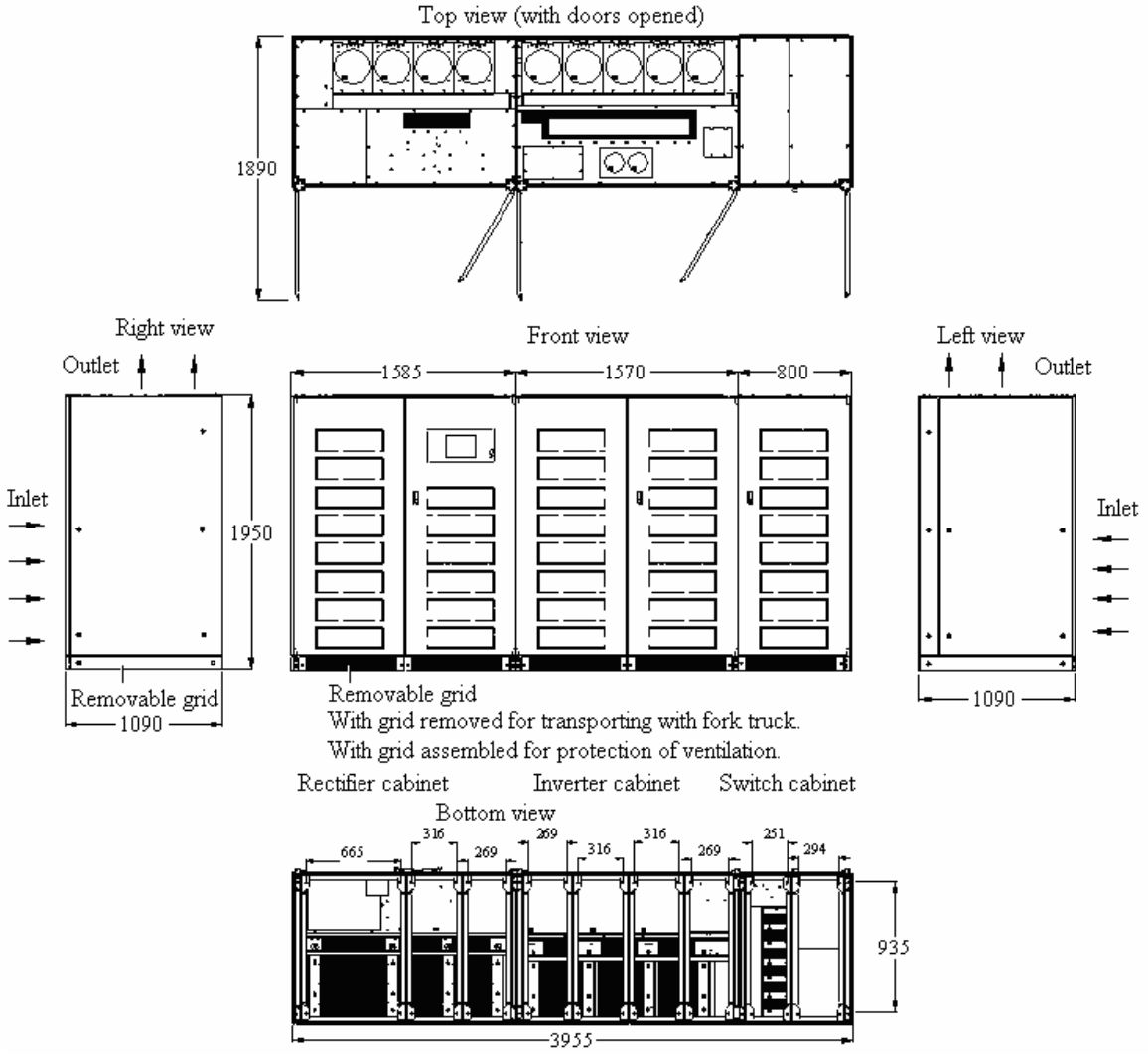


Fig.2- 4 Top, front, side and bottom views of 800kVA UPS (unit in mm)

3. Electrical Installation

This chapter introduces the electrical installation of the HIPULSE-NXL 500/800kVA UPS, including the procedures or methods for power cabling and control cabling, and the distance from floor to connection point, dry contact wiring and the electrical connection between cabinets.

The UPS requires both power cabling and control cabling once it has been mechanically installed. All control cables, whether shielded or not, should be run separately from the power cables in metal conduits or metal ducts which are electrically bonded to the metalwork of the cabinets to which they are connected.

Power Cabling

  WARNING

Prior to cabling the UPS, confirm the status and positions of the switches of the UPS rectifier input power supply / bypass power supply and mains power distribution board.

Ensure that these switches are opened and attached with WARNING label so as to prevent unauthorized operation to these switches.

For cable entry, refer to *2.3.5 Cable Entry*.

System Configuration

The power cables of the system must be size with respect to the following description:

UPS input cables

The input cables must be sized for the maximum input current, including the maximum battery recharge current, given in the Table 3-1, with respect to the UPS capacity rating and the input AC voltage.

UPS bypass and output cables

The bypass and output cables must be sized for the nominal output current or bypass current, given in the Table 3-1, with respect to the UPS capacity rating and the output AC voltage.

Battery cables

Each UPS module is connected to its battery through cables, positive cables and negative cables. The battery cables must be sized for the battery discharge current when the battery voltage is close to the end-of-discharge voltage, as given in Table 3-1 with respect to the UPS capacity rating.

Cable Specificatios

The cable specifications of HIPULSE-NXL 500/800VA UPS are given in Table 3-1.

Table 3- 1 UPS power cable specifications

UPS rating *(kVA)*	Nominal current: *Amps*							Busbar bolt size				
	Input current [1]			Rated output / bypass current			Battery discharging current at minimum battery voltage [2]	Input/battery cables		Recommended torque *(Nm)*	Output/bypass input cables	Recommended torque *(Nm)*
	380V	*400V*	*415V*	*380V*	*400V*	*415V*		*Bolt*	*ΦHole*		*Nut*	
500	1068	1041	1030	760	722	696	1174	M12	13	50	M12	50
800	1703	1689	1685	1216	1155	1113	1978	M12	13	50	M12	50

Notes:
1. EN50091-3: rated load, input rated voltage of 380V/400V/415V, battery is charged with the 15% of rated current, without Trap

filter. 2. Lowest battery voltage is 400V (the lowest votlage can be set through host computer)

The power cables selection should comply with the current and voltage ratings in the above table 3-1, the requirements in table 3B in IEC60950-1 and the local electrical codes for cabling and actual application environment.

General Cautions

The following are generic guidelines only and superseded by local regulations and codes of practice where applicable:

1. The neutral conductor should be sized for 1.1 times the output / bypass phase current.

2. The protective earth conductor should be sized two times of output / bypass cables (dependent on the fault type, cable length and protection type).

3. Consideration should be given to the use of paralleled smaller cables for heavy currents, as this can ease installation considerably.

4. When sizing battery cables, a maximum volt drop of 3Vdc is permissible at the current ratings given in Table 3-1.

Cable Connection Terminals

The rectifier input, bypass input, output and battery power cables are connected to copper busbars besides the power switches, as shown in Figure 3-2. The external interface board (EIB) including the dry contacts connect to the corresponding interface of the battery interface board (BIB). See 3.3.2 *Dry contacts*, 3.3.4 *Emergent Stop Input Interface* and 3.3.7 *Battery Control*.

Protective Earth

The protective earth busbar is located near the input and output power supply connections as shown in Figure 3-2. The protective earth cable must be connected to the earth busbar and bonded to each cabinet in the system. All three cabinets must be reliably connected through parallel connection bolts. All the cabinets and cable chutes should be earthed in accordance with local regulations. The earth cable should be bounded with binding strips onto the metallic column for cabling, so as to prevent the fixing screw of the earth cable from loosening, in the case the earth cable is pulled.

 WARNING
Failure to follow the grounding procedures will result in electric hazard or fire accident.

Protective Devices

For safety concerns, it is necessary to install external circuit breakers for the input AC supply and the battery of the UPS system. Since every installation has its own characteristics, this section provides generic practical information for installation engineers, including the knowledge of operating practices, of regulatory standards, and of the equipment to be installed.

Rectifier and bypass input supply of the UPS

1. Protection against over currents and short circuits in the mains supply input

Install suitable protective devices in the distribution unit of the incoming mains supply, considering the power cable current-carrying capacity and overload capacity of the system (see Table 8-6 and Table 8-7).

2. distributed bypass

The 500/800kVA UPS uses a distributed bypass, so separate protective devices should be installed in the incoming mains distribution unit and bypass distribution unit respectively. During installation, the current carrying capacity of the power cables and the system overload capability should be taken into consideration (see table 8-6 and table 8-7).

3. Protection against earth faults

If a residual current detector (RCD) device is installed upstream of the input supply, be sure to take into account the transient and steady state earth leakage currents that are produced during start-up of the UPS.

Residual current circuit breakers (RCCB) should meet the following requirements:

Be sensitive to DC unidirectional pulse (Class A) in the entire power network

Be insensitive to transient current pulses

There is an average sensitivity that is adjustable between 0.3A and 1A.

The symbols of RCCB are shown in Figure 3-1:

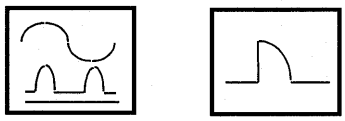


Fig.3- 1 The symbols of RCCB

There is an EMC filter inside the UPS, so residual current presents in the protective earth line and the current is between 3.5mA and 3000mA. It is recommended to confirm the sensitivity of each RCD of upstream input distribution and downstream distribution (to load).

UPS battery

The UPS Battery is protected by means of a control circuit that operates the tripping mechanism of an automatic circuit breaking device (having an adjustable tripping threshold range). The tripping mechanism uses an undervoltage release coil that activates at the minimum battery voltage level.

The circuit breaker is essential for maintenance of the battery and is normally installed near the battery.

Output of the system

If the load has an external distribution panel, protective device must differ from input of the UPS, ensure tha the protection is selectable.

Cabling Procedure

After the equipment has been finally positioned and secured, refer to Figure 3-2 to connect the power cables as described in the following procedures:

1. Verify that all the input distribution switches of the UPS are completely opened and all the UPS internal power switches are opened. Attach necessary warning signs to these switches to prevent unauthorized operation.

2. Open the front doors of the UPS rectifier cabinet and inverter cabinet (for 800kVA UPS, it is the switch cabinet), open the internal doors and then connection copper bars are visible.

3. Connect the protective earth and any necessary grounding cables to the copper grounding busbar located in the UPS rectifier cabinet or inverter cabinet (for 800kVA UPS, it is the switch cabinet).

Note: The grounding cable and neutral cable must be connected in accordance with local and national codes practice.

Distributed Bypass Connections

4. The 500/800kVA UPS uses a distributed bypass, so you need to connect the AC input supply cables to the rectifier input copper busbars (U1-V1-W1 terminals), and connect the bypass AC supply cables to the bypass input copper busbars (N2-U2-V2-W2 terminals). Be sure to tighten the fixing screws / bolts of the connections with the torque specified in Table 3-2. **ENSURE CORRECT PHASE ROTATION.**

Table 3- 2 Torques used to fix the screws / bolts of the connection cables

UPS connection cables	Nuts / bolts	Recommended torque(Nm)
Rectifier input cable	M12 bolt	50
Bypass input cable	M12 nut	50
Output cable	M12 nut	50
Battery cable	M12 bolt	50
Grounding cable	M12 bolt	50

Output System Connections

5. Connect the system output cables between the output copper busbars (N3-U3-V3-W3 terminals) and the load and tighten the fixing screws / bolts of the connections with the torque specified in Table 3-2. **ENSURE CORRECT PHASE ROTATION.**

WARNING
If the load equipment will not be ready to accept power on the arrival of the commissioning engineer then ensure that the system output cables are safely insulated at their ends.

Battery Connections

6. Connect the battery cables between the UPS terminals (+/-) and its associated battery circuit breaker, and tighten the fixing screws / bolts of the connections with the torque specified in Table 3-2. Connect shielded CAN communication cables between BIB board (battery interface board) and EIB board (external interface board). **Note: OBSERVE THE BATTERY CABLE POLARITY**.

WARNING
Do not close the battery circuit breaker until the equipment installation is completed.

7. After confirming that all the cables are connected. First close the inner door and then the cabinet door.

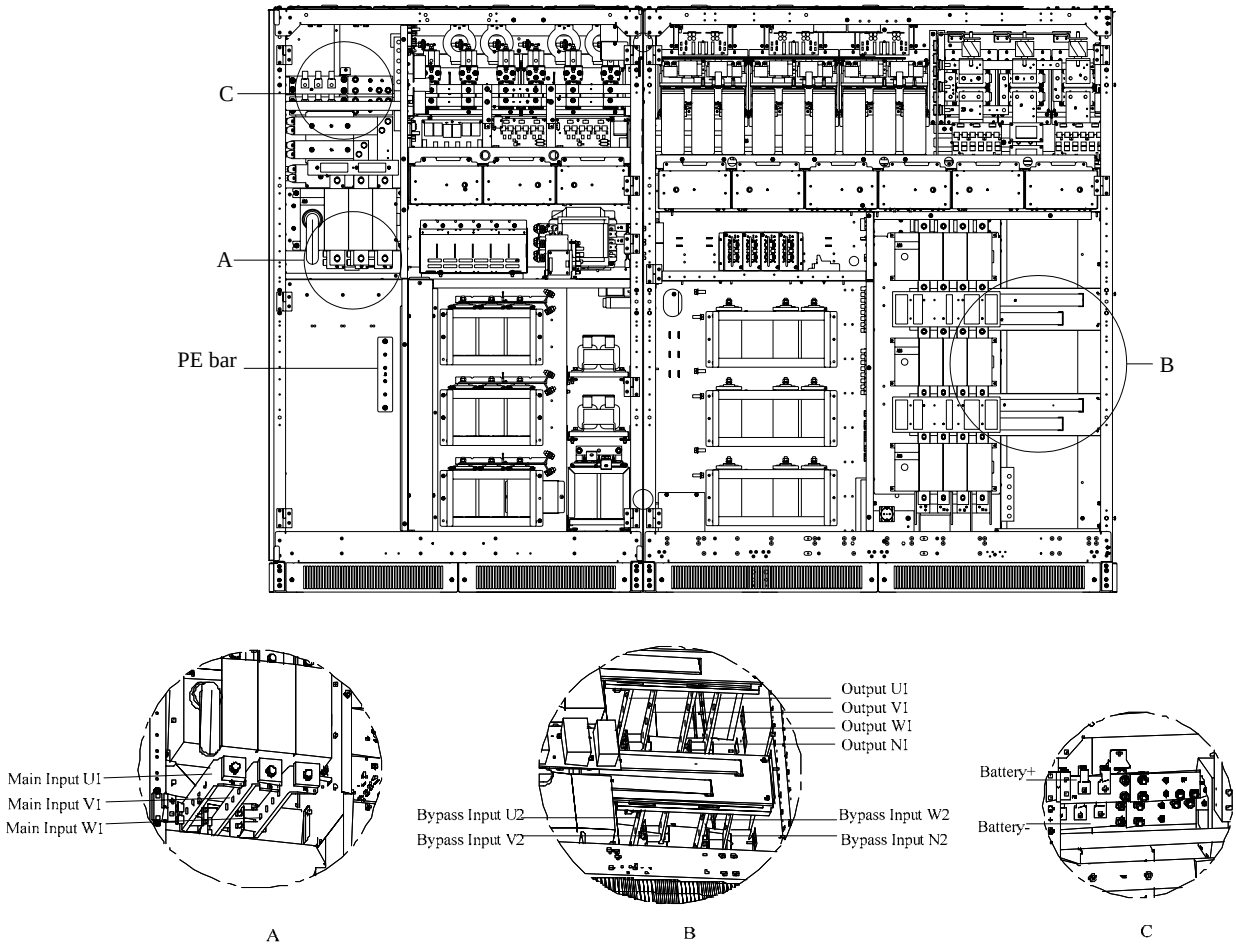


Fig.3- 2 Power cable connections for 500kVA UPS

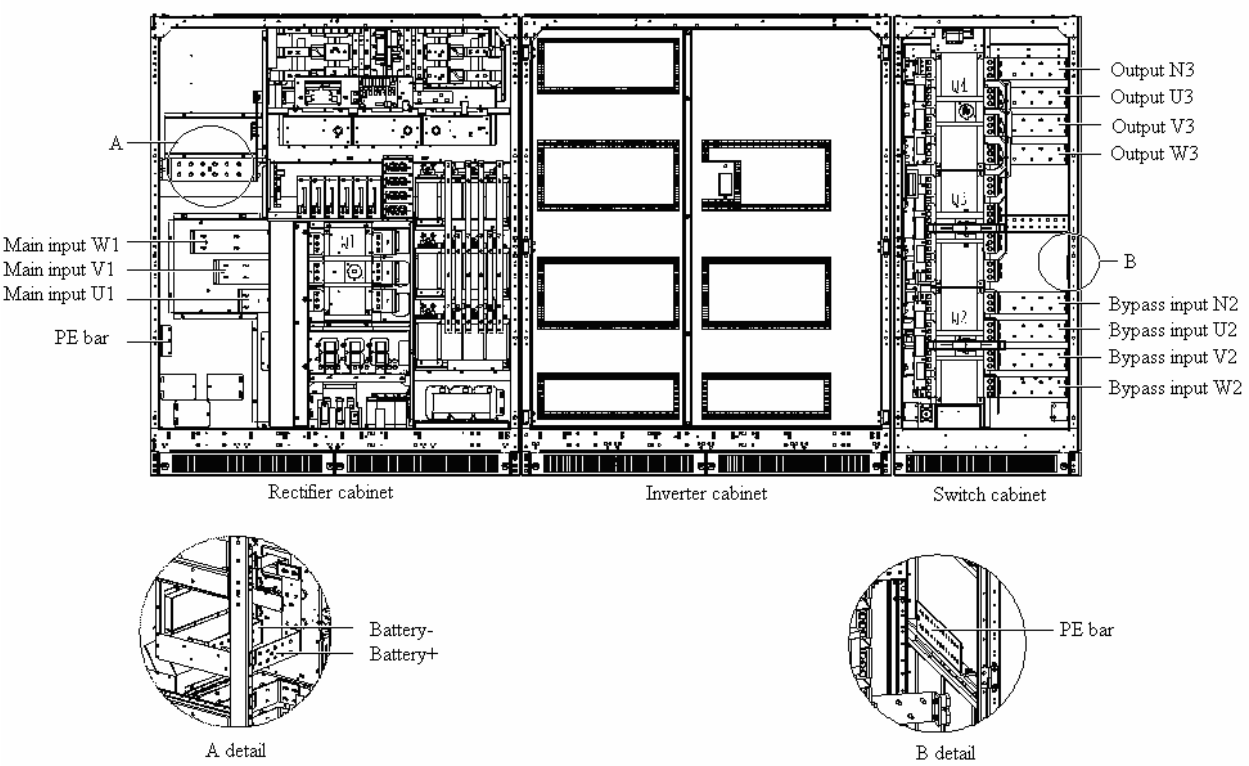


Fig.3- 3 Power cable connections for 800kVA UPS

Distance From Floor To UPS Connection Point

The distance between the UPS connection point to floor is given in Table 3-3.

Table 3- 3 The distances from floor to connection points

UPS connection points	Minimum distance to floor(mm)	
	500kVA	*800kVA*
Rectifier AC input bus	1079	690
Bypass AC input bus	543	330
UPS AC output bus	895	1323
Battery input bus	1703	1252
Grounding bus of rectifier cabinet	600	510
Grounding bus of switch cabinet	759	910
Battery CAN communication cables	1279	1200

Control Cabling

Descriptions

Based on your site's specific needs, the UPS may require auxiliary connections to manage the battery system, communicate with a personal computer or provide alarm signal to external devices or for remote Emergency Power Off (EPO). All these functions are realized through an external interface board (EIB) and the TB1101 interface on the CB interface board that is located on the back side of the front door of rectifier cabinet. As shown in Figure 3-4, the EIB provides the following ports:

dry contact input ports (X3)

dry contact output port (X1)

Emergency Power Off (EPO) input port (X2)

auxiliary DC power output port (X4)

Communication ports: Intellislot ports for intelligent card and CAN dry contact interface card

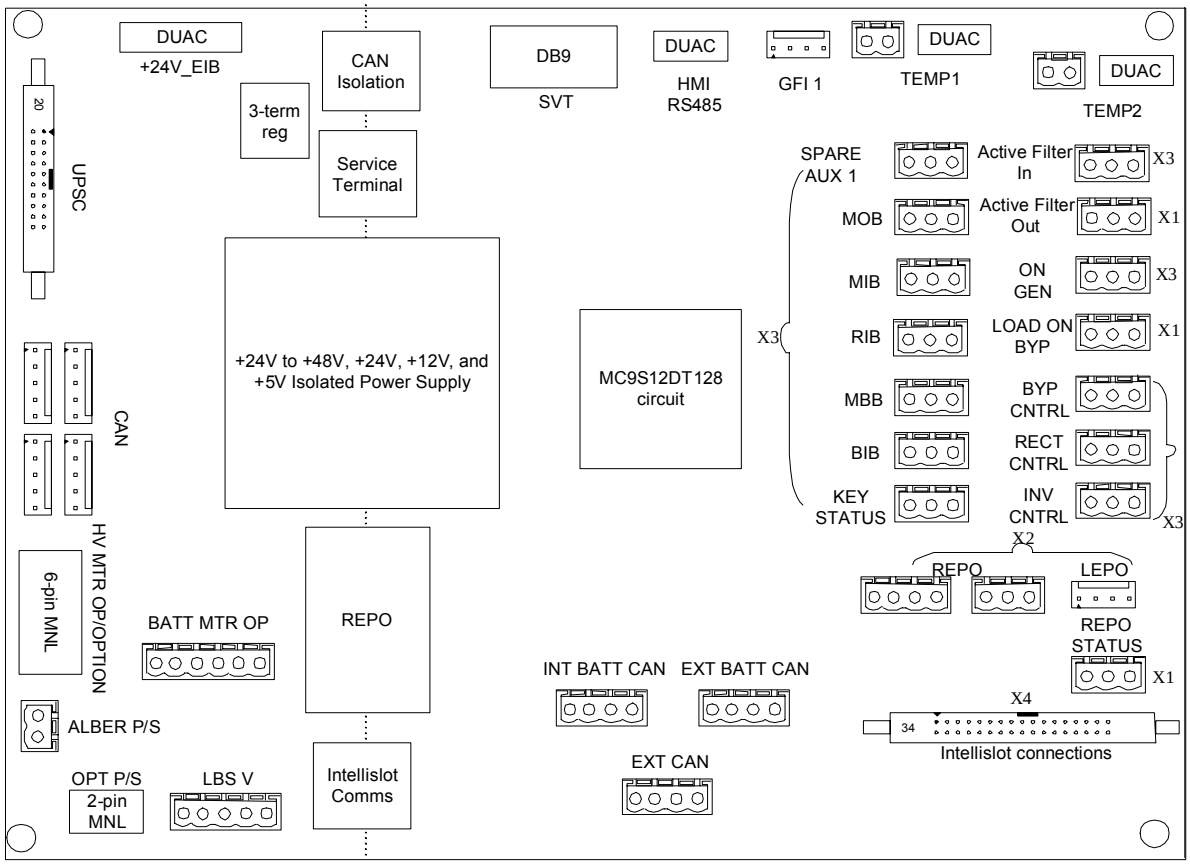


Fig.3- 4 Ports of external interface board (EIB)

Input Dry Contact Interface

X3 is the dry contact input port. The dry contact input port(X3) includes:

1. Input dry contact of auxiliary switch:

   Status detection port TB0810 of RIB (rectifier input circuit breaker) or Q11 (external input isolation circuit breaker in maintenance bypass cabinet)

   Status detection port TB0811 MIB (maintenance isolation circuit breaker) or QOP (external output isolation circuit breaker)

   Status detection port TB0812 BIB (bypass input circuit breaker) or Q22 (bypass isolation circuit breaker)

   Status detection port TB0813 MBB (maintenance bypass circuit breaker) or QBP (external maintenance bypass circuit breaker)

   TB0815 Status detection port TB0815 MOB(rectifier output circuit breaker) or QFS (external input isolation circuit breaker in transformer cabinet).

2. Input dry contact of control status:

   Detection port TB0830 of Active Filter

   Detection port TB0816 of ON_GEN(Generator powers the UPS)

   Detection port TB0817 of Rectifier

   Detection port TB0818 of Inverter

   Detection port TB0820 of Key Status(status of MBB switch lock)

   Detection port TB0821 of Rly (maintenance bypass enable)

   Detection port P0801 of GNDFLT(battery grounding fault)

The dry contact input ports are shown in Figure 3-4 and the descriptions are given in Table 3-5.

The UPS accepts external signal from zero-voltage (dry) contacts connected through Phoenix terminals. Through software programming, these signals become active when these contacts connect to +24V or to ground. The cables connected to Phoenix terminal must be separated from power cables to avoid EMI. Moreover, these cables should be double insulated with a typical 0.5 to 1.5mm^2 cross-section area for maximum connection length between 25 and 50 meters.

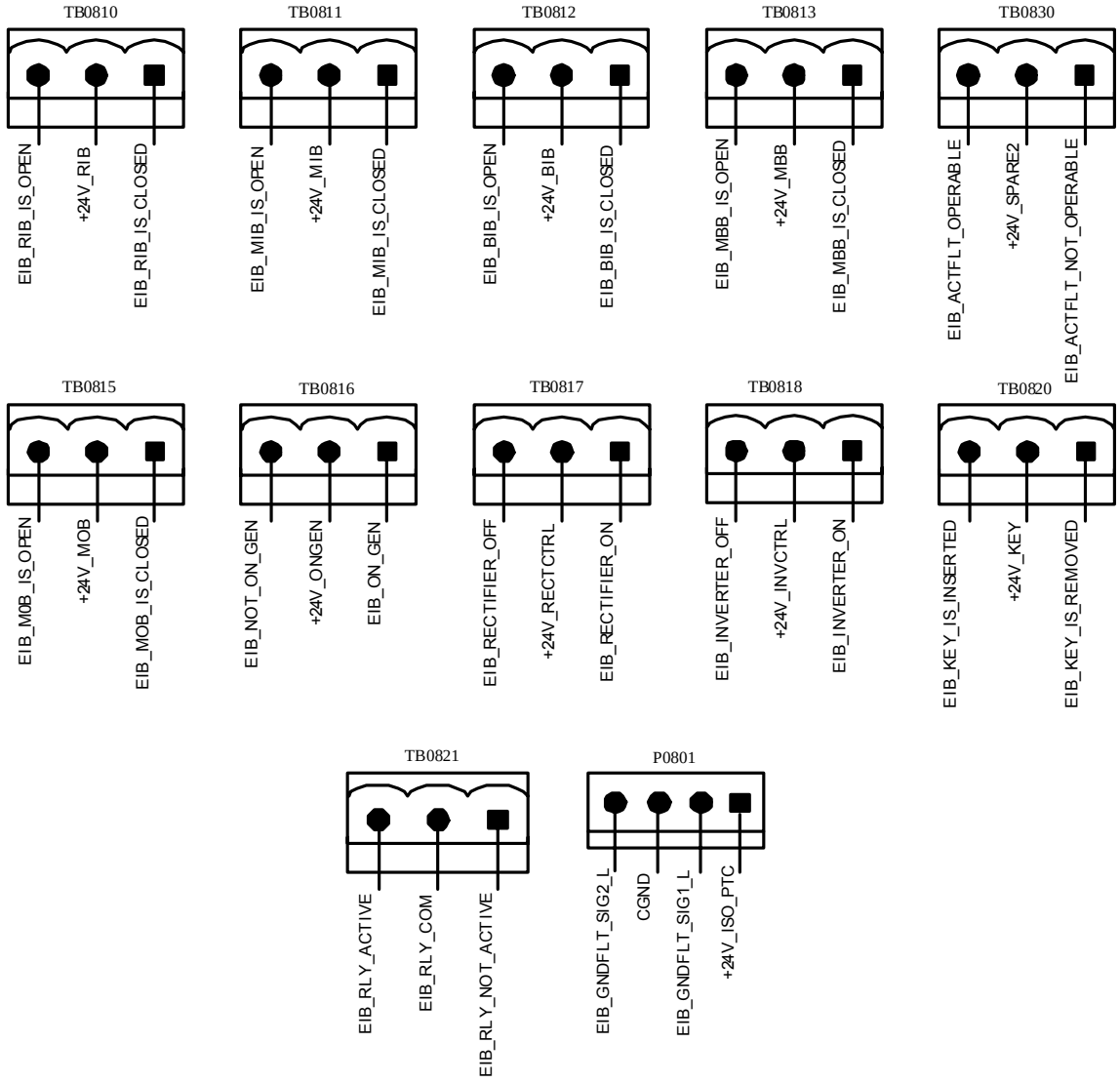


Fig.3- 5 Input dry contact port

Note
In the drawing, the black block (■) indicates pin 1, and same for the following drawings.

Table 3- 4 Description of dry contact input port

Position	Name	Meaning
TB0810.1	EIB_RIB_IS_CLOSED	Status detection of RIB or Q11(normally closed)
TB0810.2	+24V_RIB	+24V power supply
TB0810.3	EIB_RIB_IS_OPEN	Status detection of RIB (normally opened)
TB0811.1	EIB_MIB_IS_CLOSED	Status detection of MIB or QOP (normally closed)
TB0811.2	+24V_MIB	+24V power supply
TB0811.3	EIB_MIB_IS_OPEN	Status detection of MIB (normally opened)
TB0812.1	EIB_BIB_IS_CLOSED	Status detection of BIB or Q22 (normally closed)
TB0812.2	+24V_BIB	+24V power supply
TB0812.3	EIB_BIB_IS_OPEN	Status detection of BIB (normally opened)
TB0813.1	EIB_MBB_IS_CLOSED	Status detection of MBB or QBP (normally closed)
TB0813.2	+24V_MBB	+24V power supply
TB0813.3	EIB_MBB_IS_OPEN	Status detection of MBB (normally opened)
TB0815.1	EIB_MOB_IS_CLOSED	Status detection of MOB or QFS (normally closed)
TB0815.2	+24V_MOB	+24V power supply
TB0815.3	EIB_MOB_IS_OPEN	Status detection of MOB (normally opened)
TB0830.1	EIB_ACTFLT_OPERABLE	Active filter can work (normally closed)
TB0830.2	+24V_SPARE2	+24V power supply
TB0830.3	EIB_ACTFLT_NOT_OPERABLE	Active filter cannot work (normally opened)
TB0816.1	EIB_ON_GEN	Generator powers the UPS (normally opened)
TB0816.2	+24V_ONGEN	+24V power supply
TB0816.3	EIB_NOT_ON_GEN	Generator does not power the UPS (normally closed)
TB0817.1	EIB_RECTIFIER_ON	Rectifier works(normally opened)
TB0817.2	+24V_RECTCTRL	+24V power supply
TB0817.3	EIB_RECTIFIER_OFF	Rectifier shuts down(normally closed)
TB0818.1	EIB_INVERTER_ON	Inverter works (normally opened)
TB0818.2	+24V_INVCTRL	+24V power supply
TB0818.3	EIB_INVERTER_OFF	Inverter does not work (normally closed)
TB0820.1	EIB_KEY_IS_REMOVED	MBB switch lock is disabled(normally opened)
TB0820.2	+24V_KEY	+24V power supply
TB0820.3	EIB_KEY_IS_INSERTED	MBB switch lock is enabled(normally closed)
TB0821.1	EIB_RLY_NOT_ACTIVE	Maintenance bypass is disabled(normally closed)
TB0821.2	+24V_RLY_COM	Power supply earth
TB0821.3	EIB_RLY_ ACTIVE	Maintenance bypass is enabled (normally opened)
P0801.1	+24_ISO_PTC	+24V power supply
P0801.2	EIB_GNDFLT_SIG1_L	Battery grounding fault signal 1
P0801.3	CGND	Signal ground
P0801.4	EIB_GNDFLT_SIG2_L	Battery grounding fault signal 2

Note

All auxiliary cables must be double insulated twisted cables with cross sectional area of 0.5~1.5mm^2.

Dry Contact Output Port

X1 is the dry contact output port.

X1 port provides 3 dry contact output signals. The pins of dry contact port are shown in Figure 3-5 and the descriptions of the port are given in Table 3-5:

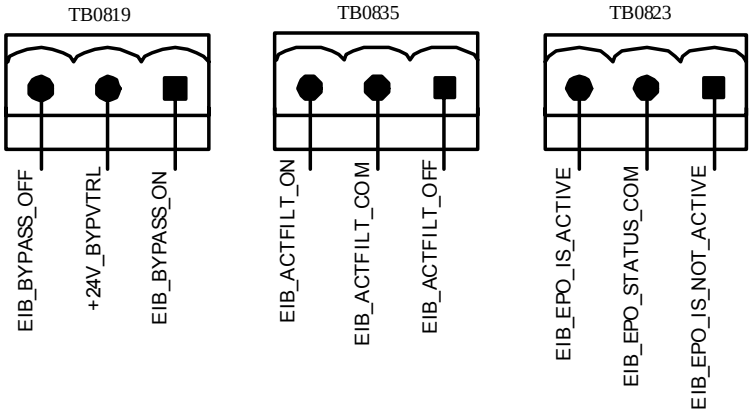


Fig.3- 6 Output dry contact port

Table 3- 5 Description of dry contact output port

Position	Name	Meaning
TB0819.1	EIB_BYPASS_ON	Bypass is on(normally closed)
TB0819.2	+24V_BYPVTRL	+24V power supply
TB0819.3	EIB_BYPASS_OFF	Bypass is off(normally opened)
TB0835.1	EIB_ACTFILT_OFF	Active filter is off(normally opened)
TB0835.2	EIB_ACTFILT_COM	Power supply earth
TB0835.3	EIB_ACTFILT_ON	Active filter is on (normally closed)
TB0823.1	EIB_EPO_IS_NOT_ACTIVE	EPO is disabled (normally closed)
TB0823.2	EIB_EPO_STATUS_COM	Power supply earth
TB0823.3	EIB_EPO_IS_ ACTIVE	EPO is enabled (normally opened)

Note

All auxiliary cables must be double insulated twisted cables with cross sectional area of 0.5~1.5mm^2.

EPO Input Port

X2 is EPO input port.

The UPS has an Emergency Power Off (EPO) function. This function can be activated by pressing a button on the front door of UPS rectifier cabinet or through a remote contact provided by the user. The UPS provides 3 kinds of EPO functions, which are REPO(remote EPO), REPO_FORM_C(remote EPO) and LEPO(local EPO). REPO and REPO_FORM_C have different interfaces. However their effects are same. LEPO is the EPO button on the front door of UPS rectifier cabinet.

Figure 3-7 shows the two kinds of EPO input ports. The NC and NO of REPO input port are compatible, but the NC of REPO_FORM_C input port is just inverse to NO. Figure 3-7 shows the local EPO input port. The descriptions of these three ports are given in table 3-6.

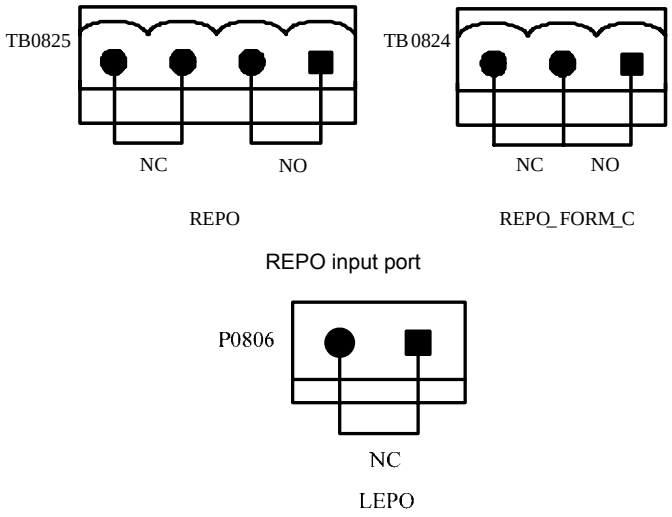


Fig.3- 7 LEPO input port

Table 3- 6 Description of EPO input relay

Position	Name	Meaning
TB0825.1	REPO_NO	EPO is activated when it is short circuited with TB0825.2
TB0825.2	REPO_NO	EPO is activated when it is short circuited with TB0825.1
TB0825.3	REPO_NC	EPO is activated when it is disconnected from TB0825.4
TB0825.4	REPO_NC	EPO is activated when it is disconnected from TB0825.3
TB0824.1	REPO_FORM_C_NO	EPO is activated when it is short circuited with TB0824.2
TB0824.2	REPO_FORM_C_NO (C)	EPO is activated when it is short circuited with TB0824.1 and disconnected from TB0824.3
TB0824.3	REPO_FORM_C_NC	EPO is activated when it is disconnected from TB0824.2
P0806.1	LEPO.NC	EPO is activated when it is disconnected from P0806.1
P0806.2	LEPO.NC	EPO is activated when it is disconnected from P0806.2

The external emergency power off device uses shielded cables to connect to the normally open or normally closed REPO switch between the two terminals of REPO or REPO_FORM_C. If REPO function is not needed, take the following steps:

1. Disconnect pin 1 and pin 2 of TB0825, and short circuit pin 3 and pin 4 of TB0825.

2. Short circuit pin 2 and pin 3 of TB0824, and disconnect pin 1 of TB0824.

If LEPO function is not needed, short circuit pin 1 and pin 2 of P0806.

Note

The emergency stop action within the UPS shuts down the rectifier, inverter and static bypass. However, it does not internally disconnect the mains input power supply. To disconnect ALL power to the UPS, open the upstream input circuit breaker(s) when the EPO is activated.

Auxiliary DC power output port

The auxiliary DC power output port X4 provides auxiliary DC power for optional SNMP card. X4 connects the pin 6 of Intellislot intelligent communication port. The voltage is 11V. The maximum current is 650mA.

Communication Ports

The communication ports are the Intellislot intelligent communication ports and CAN dry contact interface card.

HIPULSE-NXL 500/800kVA UPS offers 1 Intellislot intelligent communication port and 1 port for CAN dry contact interface card, which are used for installing the communication optional part of SNMP card and dry contact card.

Intellislot only supports RS485 serial port communication and the supported monitoring devices include SNMP card. The CAN port supports CAN communication and the supported monitoring devices include the dry contact card.

Battery Circuit Breaker Interface

EXT BATT CAN (TB1154A) is the interface of battery circuit breaker.

The BCB (battery circuit breaker) is controlled by the BIB (Battery interface board). Both are located in the battery box(cabinet). This BIB controls the under-voltage release coil of battery circuit breaker. When DC under voltage happens, UPS control circuit sends signal to this coil to trip the battery circuit breaker, and it also provides a path for the circuit breaker auxiliary contacts to report the circuit breaker status to the UPS control logic.

The BIB connects to the UPS through the EXT BATT CAN(TB1154A) port on the EIB board on UPS rectifier cabinet. The pin distribution of TB1154A port is shown in Figure 3-8. The pin descriptions are given in Table 3-7.

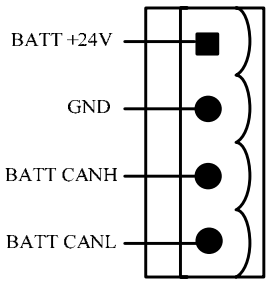


Fig.3- 8 Pins of TB1154A port

Table 3- 7 Definition of TB1154A port

Pins	Label	Meaning
1	BATT +24V	Power supply +
2	GND	Power supply earth
3	BATT CANH	CAN signal
4	BATT CANL	CAN signal
Notes 1. The CAN cable of battery must be shielded and the shielding layer should be earthed. 2. Use multiple-conductor shielded cables with a cross sectional area of 0.5 to 1.5 mm^2.		

Connect the BCB control cables between the UPS EIB (external interface board) and BIB as shown in Figure 6-5. All these cables should be shielded. The temperature detecting sensor should be connected to P1153 of BIB.

Note
If battery temperature compensation is needed, this function must be activated through the host computer by the commissioning engineer.

TB1101 Port

The TB1101 port on the CB interface board provides the drive signal of 48VDC coil. In addition, it sends the switching signal of BFB (bypass back-feeding circuit breaker) to UPSC board. The pins of TB1101 port are shown in Figure 3-9 and the descriptions of pins are given in Table 3-8.

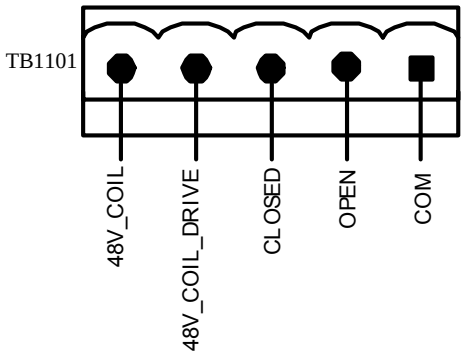


Fig.3- 9 Pins of TB1101 port

Table 3- 8 Definition of pins of TB1101port

Pins	*Name*	*Meaning*
TB1101.1	COM	48V power supply-
TB1101.2	OPEN	CB is opened
TB1101.3	ClOSED	CB is closed
TB1101.4	48V_COIL_DRIVE	48VDC coil drive signal
TB1101.5	48V_COIL	48V power supply +
Note: 1. After BFB is enabled, the pin 4 and pin 5 TB1101port of CB interface board output 0V. 2. When bypass back-feeding happens, the pin 4 and pin 5 TB1101 port of CB interface board output 48V/40ms pulse signal to trip BFB. 3. The TB1101 output load of CB interface board needs to connect the inductive components (with coils).		

Electrical Connection Between Cabinets

HIPULSE-NXL 500/800kVA UPS cabinets include multi cabinets. The electrical connection among these cabinets are needed after the mechanical connections, which include power connection and signal connection.

Power Connections

The power connections among the cabinets of HIPULSE-NXL 500/800kVA UPS are made through power cables and copper busbars. The installation engineers must connect the copper busbars strictly according to the illustration drawings. The recommended torque of M12 bolt / nut is 50Nm.

There is only copper busbar connection between rectifier cabinet and inverter cabinet of 500kVA UPS and there is no power cable connection between them. The connections of copper busbars are shown in Figure 3-10.

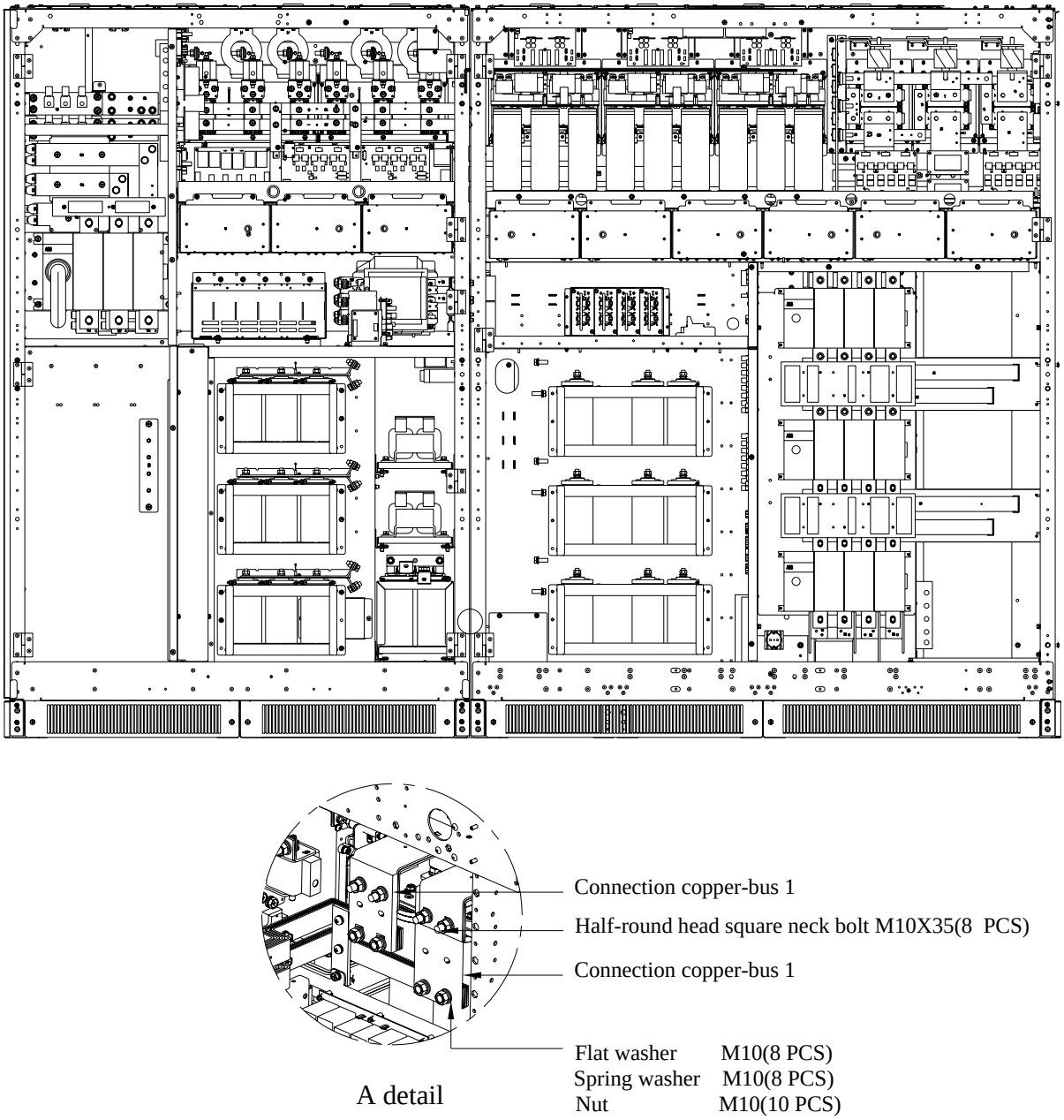


Fig.3- 10 Copper bus connections between 500kVA UPS rectifier cabinet and inverter cabinet

The connections of power cables of 800kVAUPS are shown in Figure 3-11 and the connections of copper busbars are shown in Figure 3-11 to Figure 3-16. There is only copper busbar connection between rectifier cabinet and inverter cabinet and there is no power cable connection between them. But there are both copper busbar connection and power cable connection between inverter cabinet and switch cabinet. The connection methods of power cables are shown in Table 3-9.

Table 3- 9 Power cable connection method between 800kVA UPS inverter cabinet and switch cabinet

Label of power cable	Start point(inverter cabinet)	End point(switch cabinet)	Quantity	Meaning
W28	TOUT-X0, neutral line of transformer	Neutral copper bus of Q4	4	Output neutral line

The installation engineers must connect the copper busbars strictly according to the illustration drawings. The recommended torque of M12 bolt/nut is 50Nm.

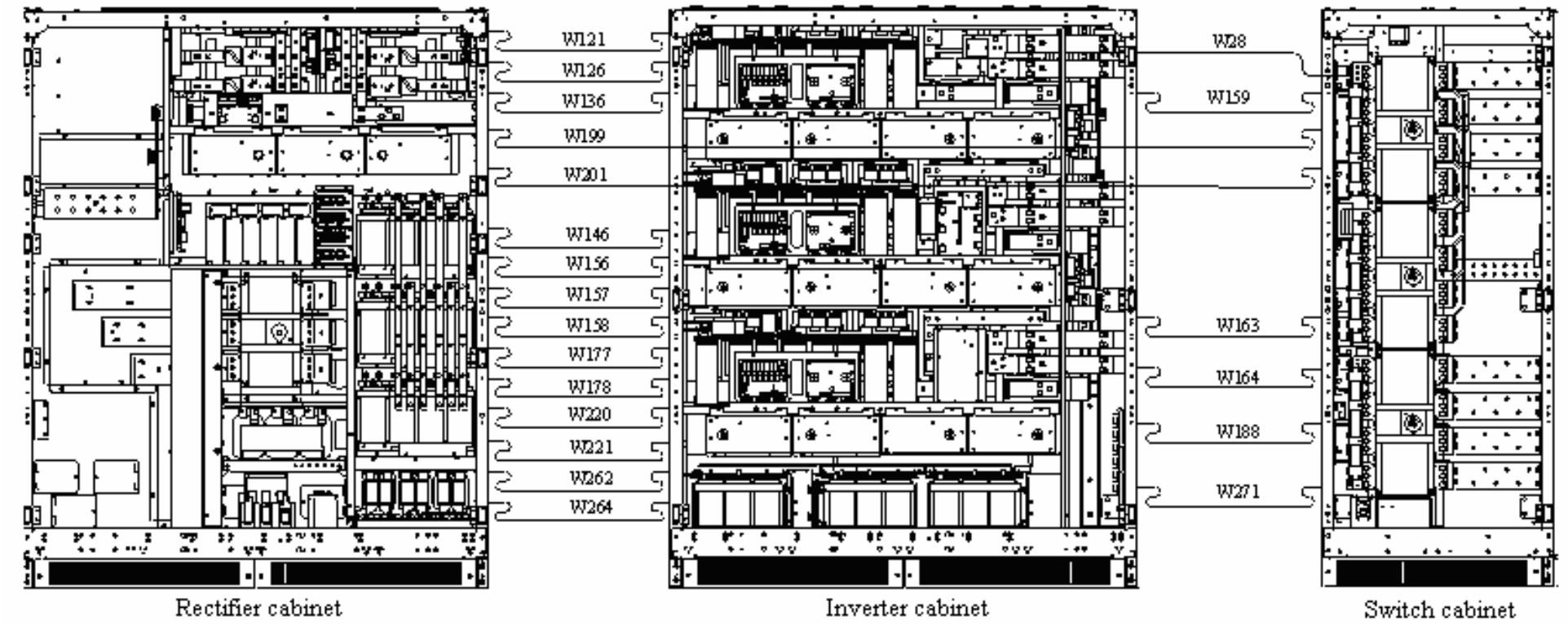


Fig.3- 11 Power cable connections among rectifier cabinet, inverter cabinet and switch cabinet

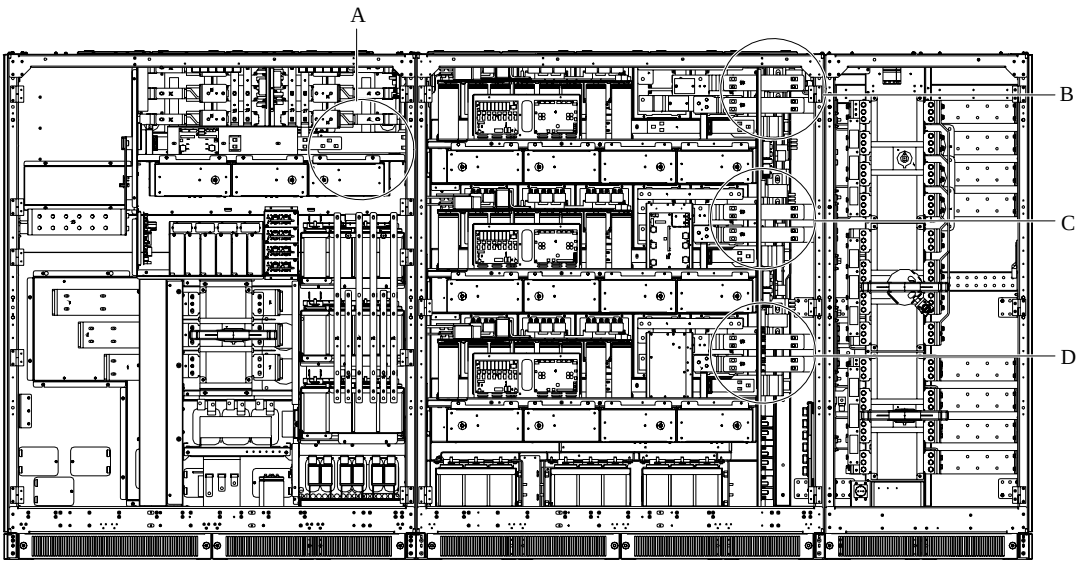


Fig.3- 12 Copper bus connections among rectifier cabinet, inverter cabinet and switch cabinet

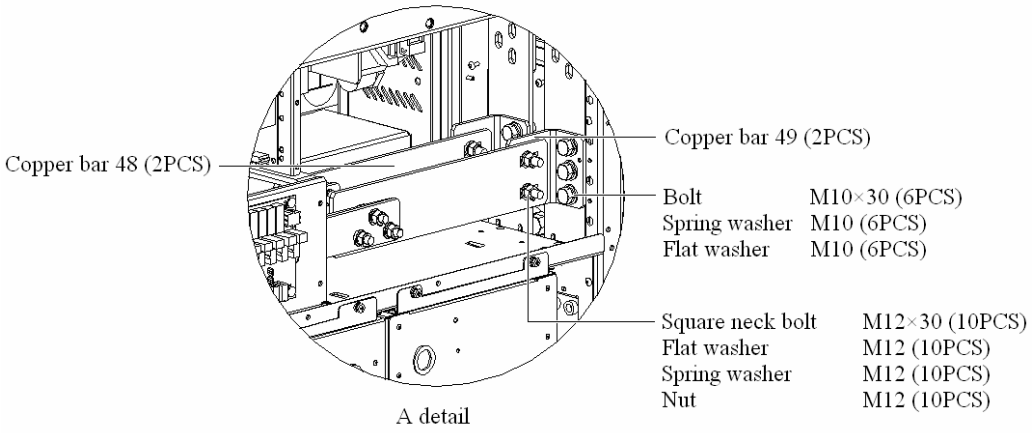


Fig.3- 13 Enlarged view of copper busbar connections between UPS rectifier cabinet and inverter cabinet

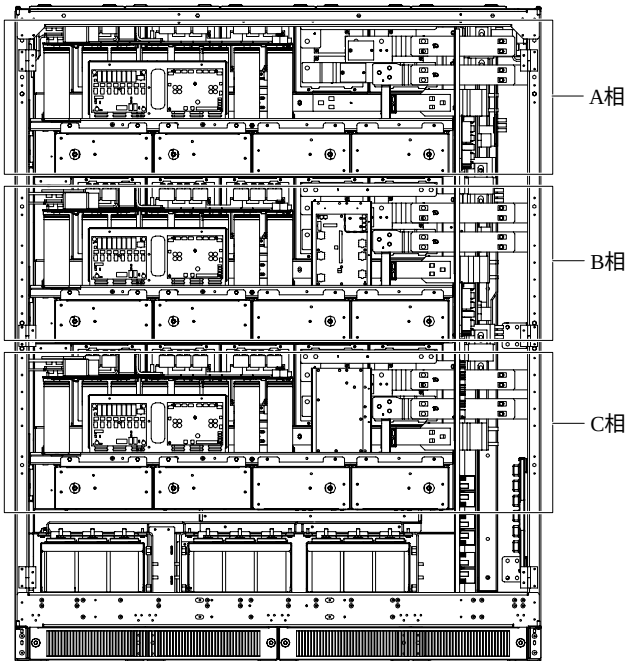


Fig.3- 14 Phase A/B/C of UPS inverter cabinet

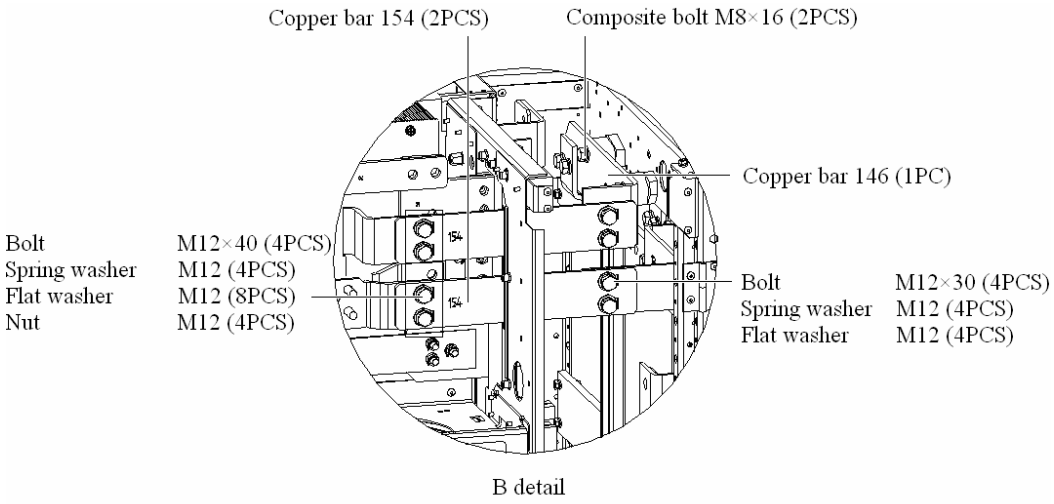


Fig.3- 15 Detailed view of copper busbar connection between phase A of UPS inverter cabinet and switch cabinet

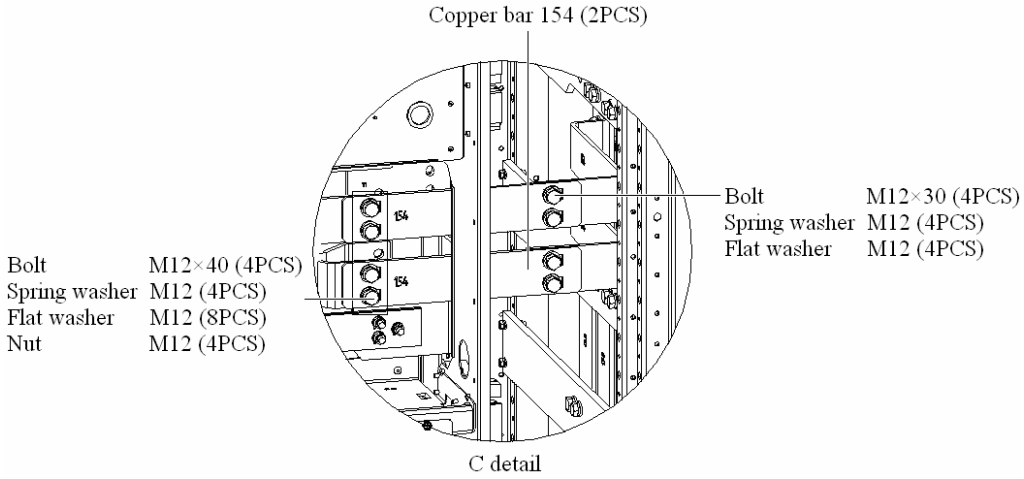


Fig.3- 16 Enlarged view of copper busbar connection between phase B of UPS inverter cabinet and switch cabinet

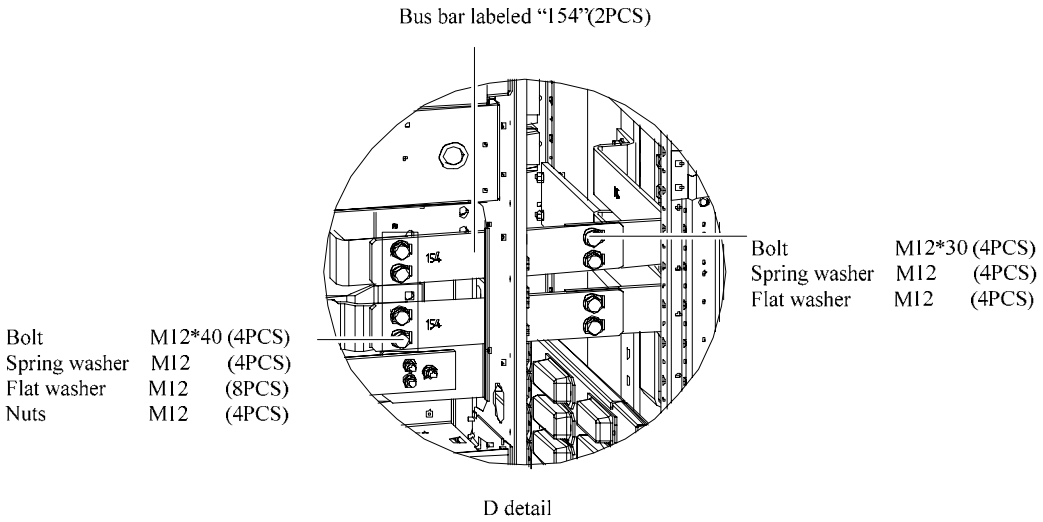


Fig.3- 17 Enlarged view of copper busbar connection between phase C of UPS inverter cabinet and switch cabinet

Signal Connection

There are signal cables connected between the HIPULSE-NXL 500/800kVA UPS cabinets. When connecting the signal cables, be sure to connect them to the corresponding ports on associated boards.

The connection of the signal cables between the rectifier cabinet and inverter cabinet of 500kVA UPS is described in table 3-10.

Table 3- 10 Signal cable connections between 500kVA UPS rectifier cabinet and inverter cabinet

Label of signal cable	Start point(rectifier cabinet)	Start or end point(inverter cabinet)	Quantity	Meaning
W121	02-806701 board, P0300SS port	02-806803O board, P0300 port	1	INV output SCR drive
W126	02-806701 board, P0400A port	02-806704 board, phase A P0400 port	1	IGBT phase A drive
W133	02-806701 board, P0400B port	02-806704 board, phase B P0400 port	1	IGBT phase B drive
W141	02-806701 board, P0400C port	02-806704 board, phase C P0400 port	1	IGBT phase C drive
W180	02-806708 board, P55 port	UL544CSA8 board, P55A port	1	EIB board power supply
W221	02-806710#1 board, P1011 port	UL544CSA8 board, P1011A port	1	Fan board 1 power supply
W290	02-806708 board, P0814 port	UL544CSA8 board, P814A port	1	DC fuse detecting
W300	02-806701 board, P0500 port	UL544CSA8 board, P0500A port	1	BPSS board signal transmission
W301	02-806701 board, P0501 port	UL544CSA8 board, P0501A port	1	BPSS board signal transmission
W302	02-806701 board, P0700 port	UL544CSA8 board, P0700A port	1	VI Load board signal transmission
W303	02-806701 board, P0701 port	UL544CSA8 board, P0701A port	1	VI Load board signal transmission
W306	02-806701 board, P99 port 02-806802 board, P66 port	UL544CSA8 board, PAA port	1	CAN line A loop
W307	02-806710#1 board, P66 port 02-806708 board, P99B port	UL544CSA8 board, PBA port	1	CAN line B loop
W308	02-806701 board, P1300 port	UL544CSA8 board, P1300A port	1	Signal transmission of auxiliary power supply
W309	02-806701 board, P1302 port	UL544CSA8 board, P1302A port	1	Signal transmission of auxiliary power supply
W311	Q1_A2 copper busbar of rectifier circuit breaker Q1_B2 copper busbar of rectifier circuit breaker	UL544CSA8 board, P1304A port	1	Power source for auxiliary power supply

The signal connection between rectifier cabinet, inverter cabinet and switch cabinet of 800 KVA UPS is shown in Figure 3-11.

Table 3- 11 Signal connection between rectifier cabinet, inverter cabinet and switch cabinet

Label of signal cable	Start point(rectifier cabinet)	Start or end point(inverter cabinet)	End point(switch cabinet)	Quantity	Meaning
W121	02-806701 board, P0300SS port	02-806803 board, P0300 port		1	INV SCR drive
W126	02-806701 board, P0400A port	02-806704 board, phase A P0400 port		1	IGBT phase A drive
W136	02-806701 board, P0400B port	02-806704 board, phase B P0400 port		1	IGBT phase B drive

Label of signal cable	Start point(rectifier cabinet)	Start or end point(inverter cabinet)	End point(switch cabinet)	Quantity	Meaning
W146	02-806701 board, P0400C port	02-806704 board, phase C P0400 port		1	IGBT phase C drive
W156	ULW346SX1 board, P44 port	(BPSS) board, P44 port		1	Power supply
W157	02-806701 board, P0500 port	BPSS board, P0500 port		1	Bypass detecting signal
W158	02-806701 board, P0501 port	BPSS board, P0501 port		1	Bypass drive signal
W159		BPSS board, P0502 port	circuit breaker Q2	1	bypass input detection
W163		BPSS board, P1100B port	auxiliary contacts of circuit breaker Q3	1	Switching status detecting
W164		BPSS board, P1100C port	auxiliary contacts of circuit breaker Q2	1	Switching status detecting
W177	02-806701 board, P0700 port	02-806707 board, P0700 port		1	Load voltage and current detecting
W178	02-806701 board, P0701 port	02-806707 board, P0701 port		1	Load voltage and current detecting
W179		02-806707 board, P0702 port	circuit breaker Q4	1	Output voltage detecting
W180		02-806707 board, P0703 port	circuit breaker Q4-2	1	Rectifier voltage detecting
W185		02-806707 board, P0713 port	output current transformer CT7	1	Output phase A current detecting
W186		02-806707 board, P0714 port	output current transformer CT8	1	Output phase B current detecting
W187		02-806707 board, P0715 port	output current transformer CT9	1	Output phase C current detecting
W188		02-806707 board, P1100 port	Q4 auxiliary contacts	1	Switching status detecting
W199	ULW346SX1 board, P1305 port		Fuse base FB4	1	Bypass source for auxiliary power
W201	ULW346SX1 board, P1306 port		Fuse base FB3	1	Bypass source for auxiliary power
W220	02-806710#1 board, P1011 port	02-806716 board, P1011A port		1	power supply
W221	02-806710#1 board, P66 port	02-806710#2 board, P99 port		1	CAN cable
W262	02-806708 board, P66B port	02-806710#4 board, P66 port		1	CAN cable
W264	02-806708 board, P0814 port	DC FAP or DC F FCN		1	DC fuse status detecting
W271		02-806716 board, P1601 port	circuit breaker Q4-2	1	Powerr source for fan

4. Operator Control And Display Panel

This chapter introduces the functions and use of the components on the operator control and display panel of the HIPULSE-NXL 500/800kVA UPS, and provides LCD display information, including the LCD power flow diagram, detailed menu messages, prompt windows, EPO button and UPS alarm event list.

Introduction

The operator control and display panel is located on the front right door of the UPS rectifier cabinet as shown in Figure 4-1 and Figure 4-2. This operator control and display panel also provides LCD and EPO button. The HMI (human machine interface) of the HIPULSE-NXL 500/800kVA UPS uses touch-screen LCD design. Through this LCD panel, the operator can operate and control the UPS, and check all measured parameters, UPS and battery status and event and alarm logs. EPO button provides the emergent power off function for the user.

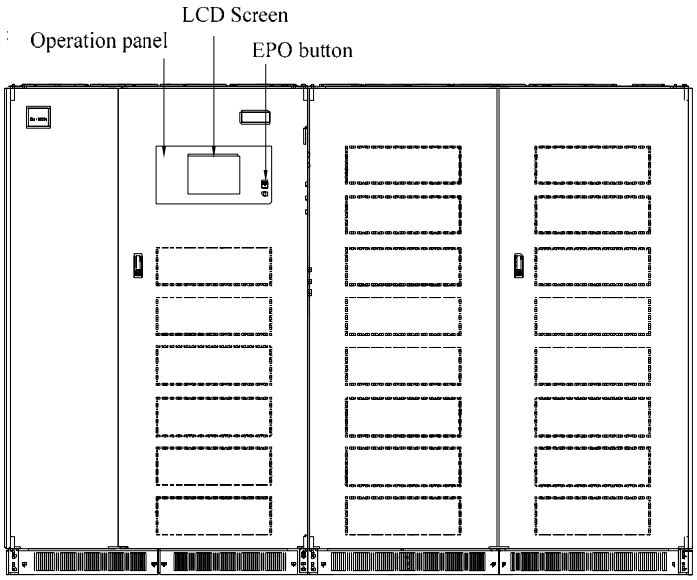


Fig.4- 1 Location of 500kVA LCD panel

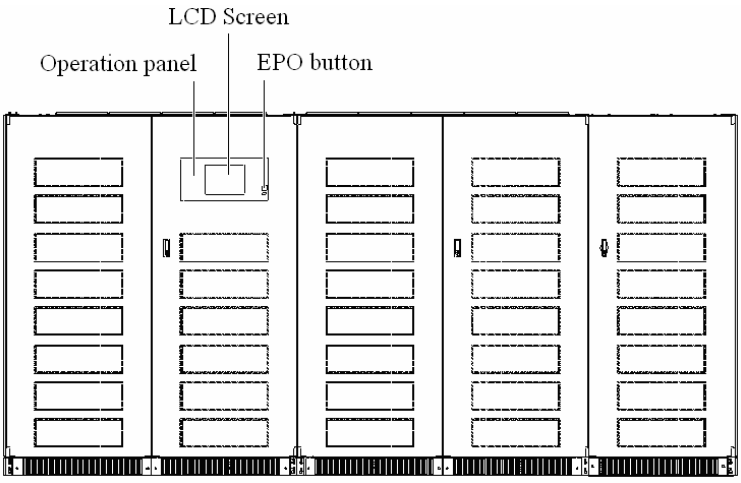


Fig.4- 2 Location of 800kVA LCD panel

The user can perform the operations through the LCD panel:

Clearly and fast display the UPS operating status

Monitor the UPS power flow and display input and output values

Execute some control operations through the panel such as switch on/off, load transfer and close Trap

Query UPS alarm and event log

Set UPS parameters

LCD Screen Types

Startup Screen

When the UPS starts up, the system is powered on and the LCD displays the startup screen that shows the characters of “HMI 2 Liebert® NXL”, and this display will last for 30 seconds, as shown in Figure 4-3.

Fig.4- 3 Startup screen

Main Display Screen

After the UPS startup is completed, the Main Display Screen is as shown in Figure 4-4:

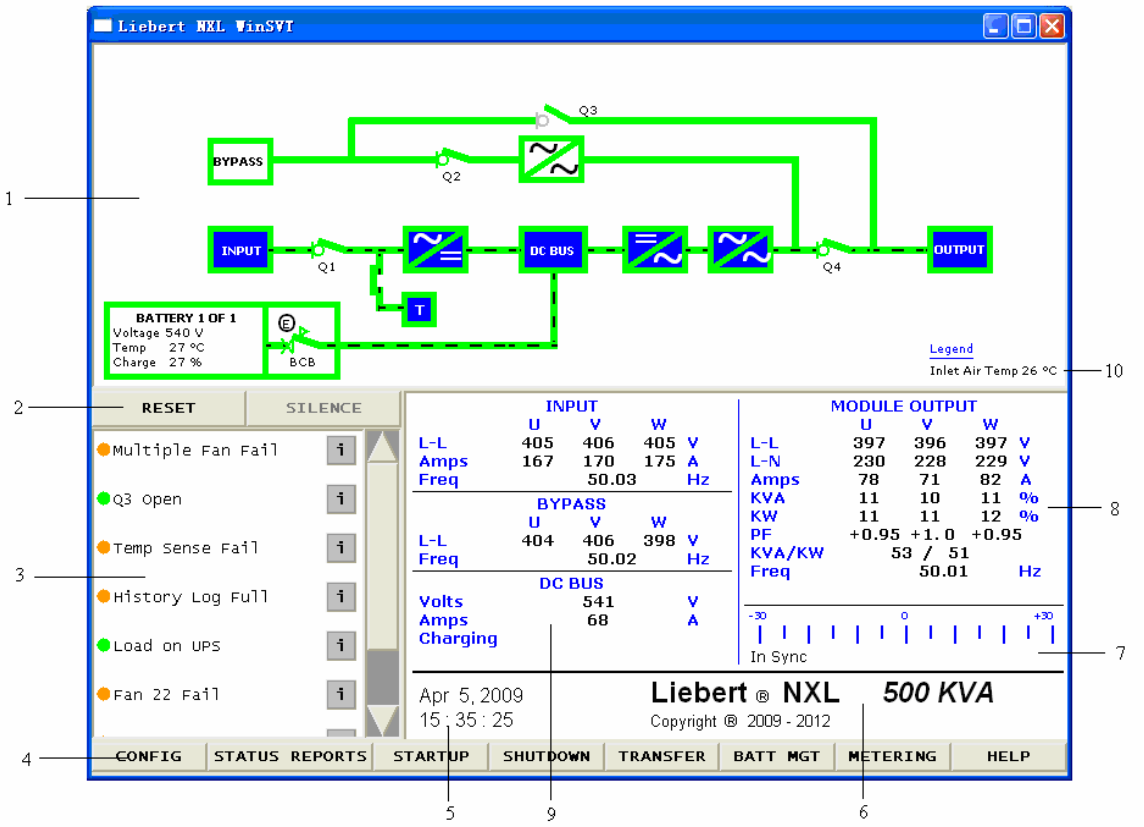


Fig.4- 4 Main Display Screen

If there is no operation to the screen for 15 minutes, the LCD backlight will turn off automatically, and then the LCD becomes dark, and enters sleeping status. The LCD will be activated and enter main display if any part of the LCD is touched.

The LCD screen can be divided into 10 zones according to its functions as shown in Table 4-1.

Table 4- 1 Layout of main display screen

Code of Zones	Descriptions
1	Power flow
2	Event clearing and alarm silence button
3	Event information zone
4	Main menu button
5	Current date and time
6	Product Logo
7	Phase lock status
8	Display zone of output parameters
9	Display zone of input parameters
10	Display zone of air inlet temperature

If the system is a parallel system, the Main Display Screen is as shown in Figure 4-5, that is, an additional “System View” menu is displayed on the upper right part of the power flow diagram, and if this menu is clicked, the parallel system information is as shown in Figure 4-6.

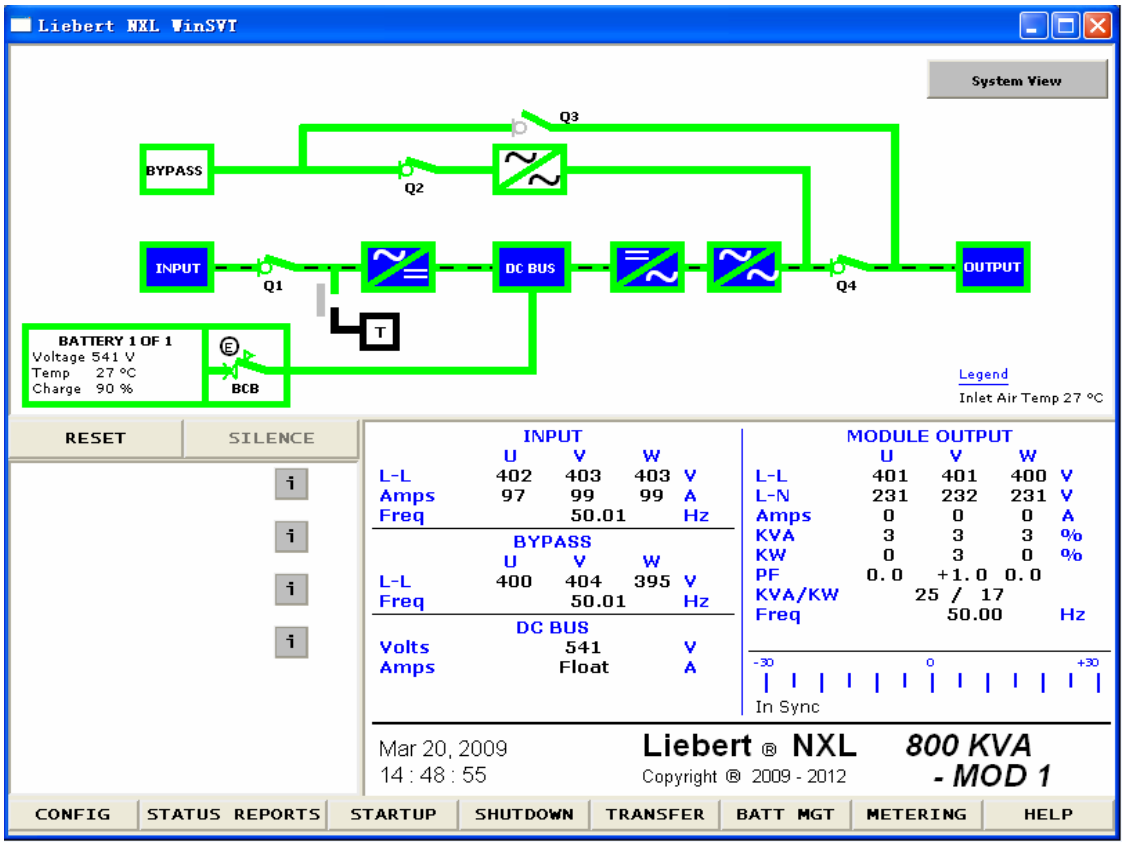


Fig.4- 5 Main Display Screen of parallel system

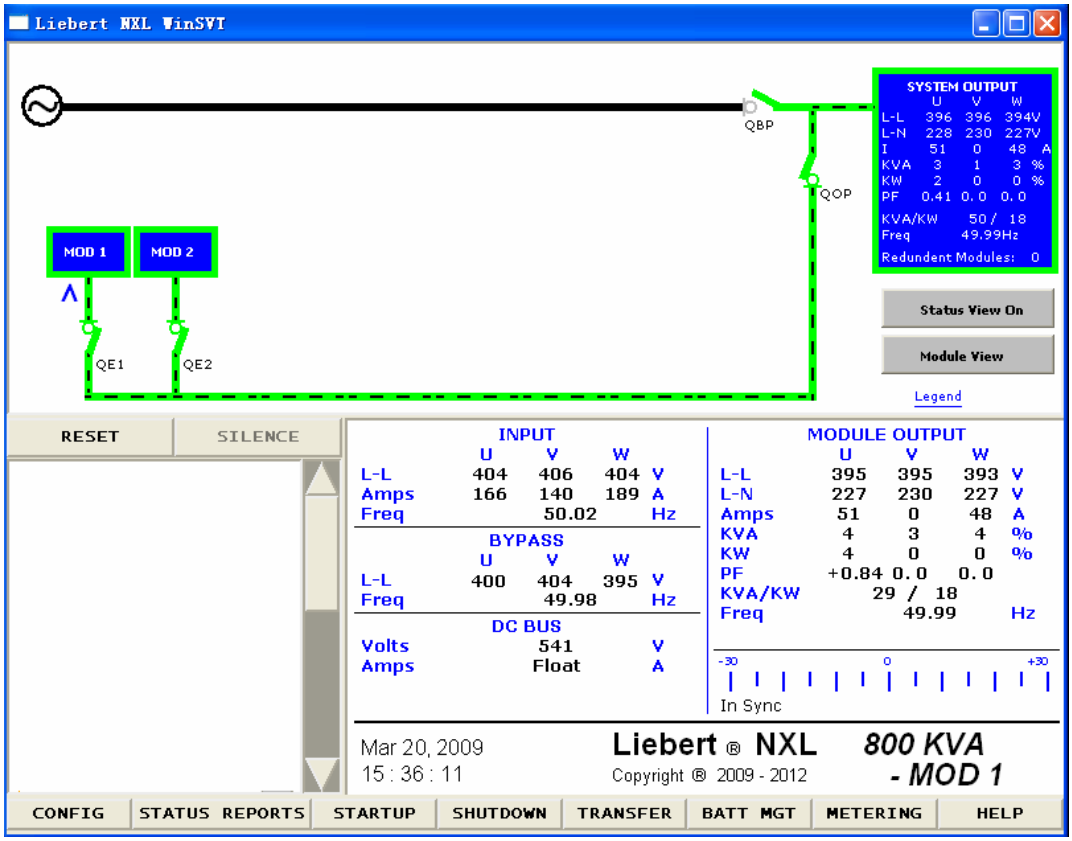


Fig.4- 6 Information of parallel system

Power Flow Diagram

Overview

The power flow diagram is consisted of input, output, block frame, switch and power path as shown in Figure 4-7. The power flow diagram is introduced as below:

Bypass input: Display bypass input line-to-line voltage and frequency, and the status of bypass switch Q2 (open or closed);

Rectifier input: Display rectifier input line-to-line voltage, input current and frequency, and the status of rectifier input switch Q1 (open or closed);

Output: Display the output line-to-line voltage, line-to-neutral voltage, output current, apparent and active power load ratio of each phase, power factor PF, apparent power KVA, active power KW and frequency. When overload happens, the remaining time before the transfer is displayed at the bottom of the frame. The re-transfer time after the transfer is also displayed here;

Bus: Display bus voltage, battery charging status (float charging or equalize charging), and battery charging or discharging current;

Battery: Display the voltage of each battery string, battery temperature and capacity, and status of BCB (Battery Circuit Breaker).

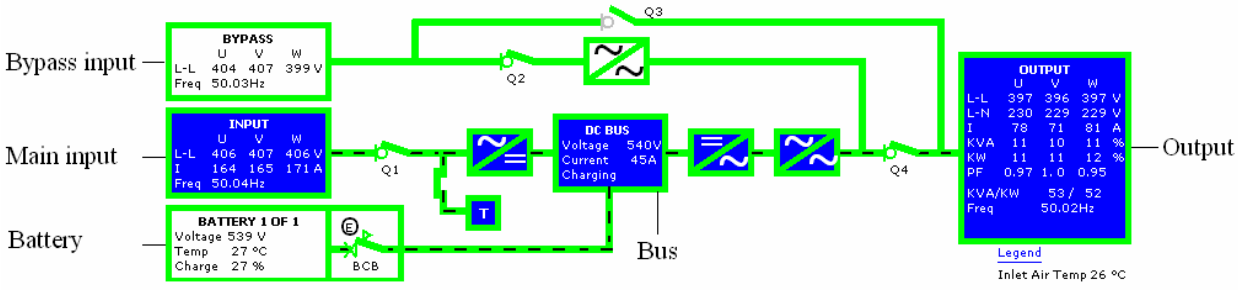


Fig.4- 7 Power flow diagram

The current operating status of UPS is indicated by the colours (green, orange, gray and black) of power paths and the status (constant green, flashing and white) of block frame. The meanings of the colours of each power path and block frame and the status block frame are given in Table 4-2.

Table 4- 2 Meanings of the color of the power path and frames

Color of power path	Meanings	Colour and status of frame	Meanings
Green	Normal operation	Constant green	Stable operation
Orange	Input power supply voltage or frequency is out of normal range	Flash	In startup or power off status
Gray	Input power supply voltage or frequency abnormal or power failure	White	Not working
Black	Not sure		

The power flow diagram of each operating mode of UPS is introduced below:

Normal mode

Figure 4-8 shows the power flow diagram of normal mode.

In normal mode, if the inverter fails or the inverter overload time is out, the system will transfer to bypass. After the fault or overload is cleared, the system transfers back to normal mode.

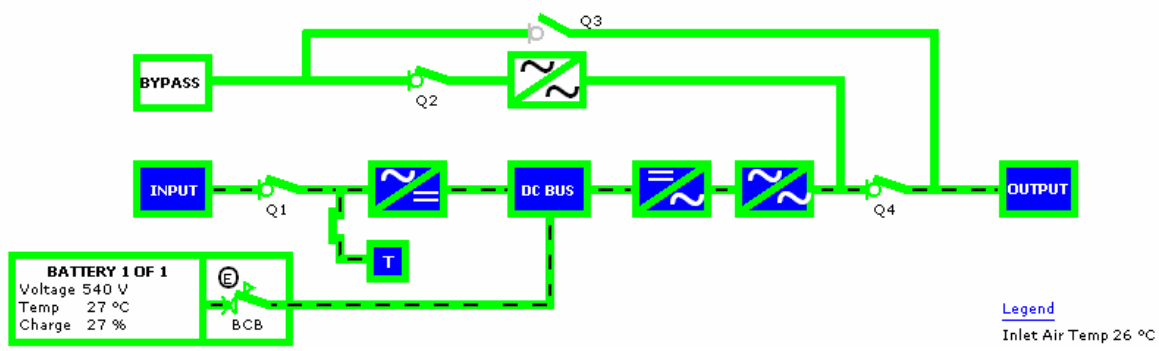


Fig.4- 8 Power flow diagram of normal mode

Bypass mode

Figure 4-9 shows the power flow diagram of bypass mode. The load is powered by bypass and at this time the quality of the power to the load is not guaranteed. The UPS works in bypass mode during startup or inverter failure.

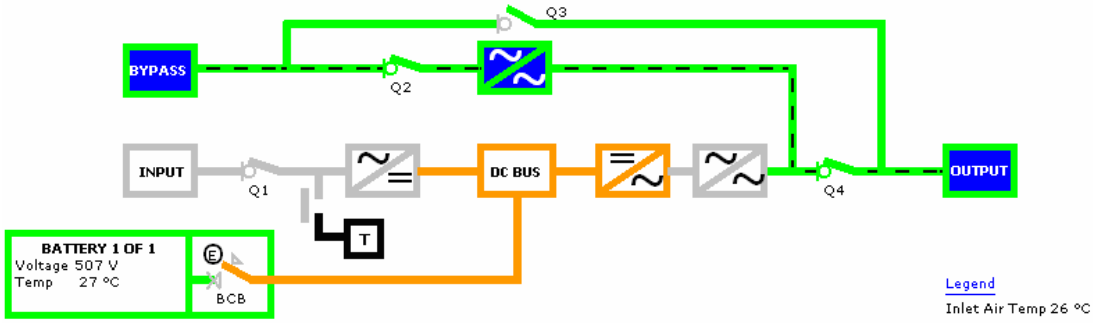


Fig.4- 9 Power flow diagram of bypass mode

Battery mode

Figure 4-10 shows the power flow diagram of battery mode. When the mains power fails or exceeds normal operation range, the battery will power the load and the operating time is determined by the battery capacity and load. When the battery voltage is close to the EOD voltage, the control panel will report alarm information of “battery voltage low”. The battery frame on the control panel displays battery voltage, battery discharging current and discharging time, and charging ratio.

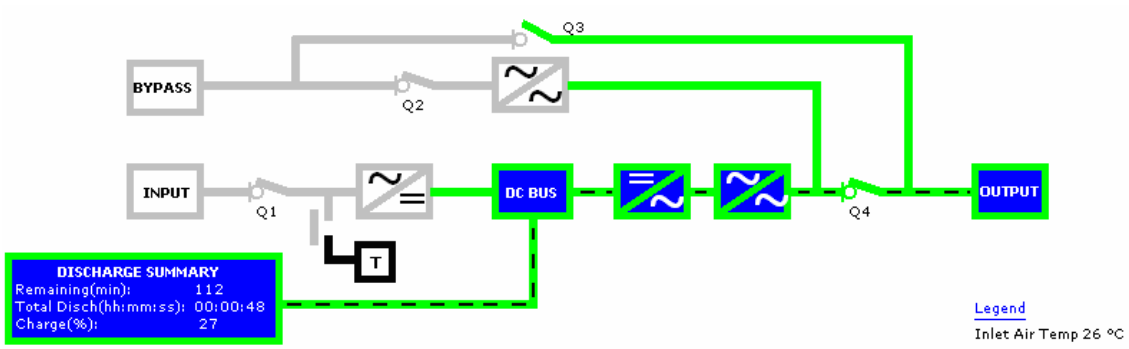


Fig.4- 10 Power flow diagram of battery mode

Maintenance bypass mode

Figure 4-11 shows the maintenance bypass mode. In this mode, the load is powered by maintenance bypass and at this time the quality of the power to the load is not guaranteed. The UPS operates in maintenance bypass mode when the system needs maintenance.

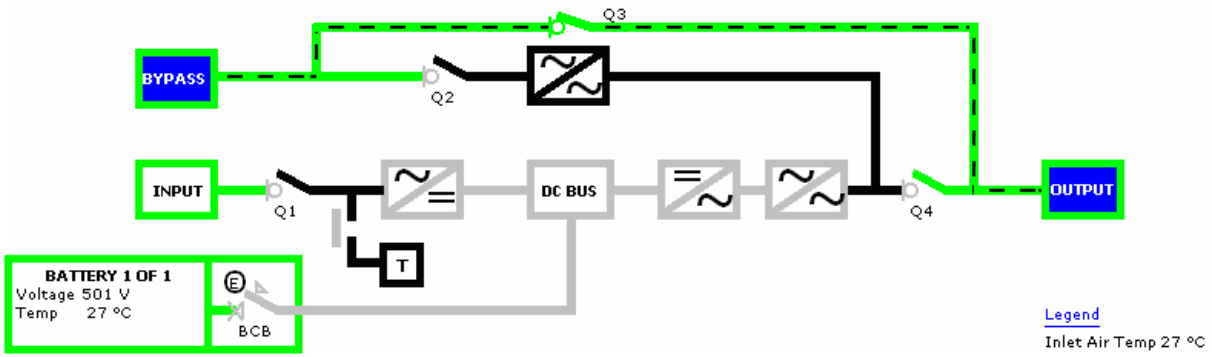


Fig.4- 11 Power flow diagram of maintenance bypass mode

Detailed Description Of Menu Items

The LCD of the HIPULSE-NXL500/ 800kVA UPS offers 10 groups of menus. The structure is shown in Figure 4-12. The functions of main menus are configuring, status reporting, switching on/off, transferring, battery management, measured values, help, alarm silence and event clearing. User can expand the menus level by level according to his actual needs and perform relevant parameter setting, status browse and system on/off operations.

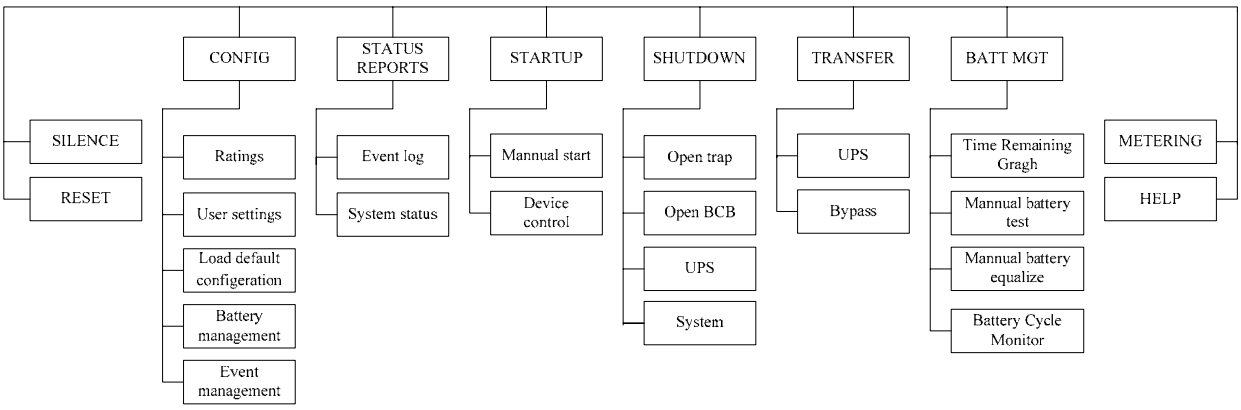


Fig.4- 12 Structure of HIPULSE-NXL 500/800kVA UPS menu tree

The menu structure shown in Figure 4-12 is described below

1.1.1 Configuration

Rated values

This menu will display the system parameters in details and will display the following parameters if it is clicked (as shown in Figure 4-13):

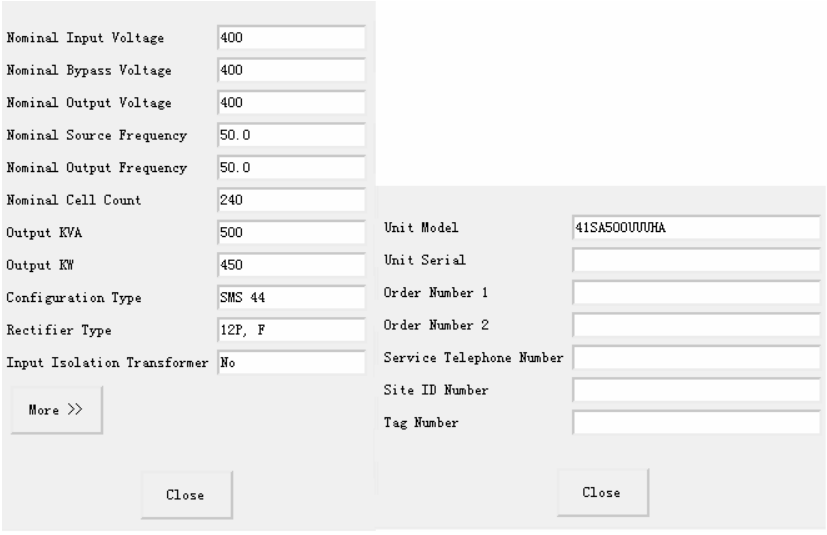


Fig.4- 13 Rated parameter drawing

System setting

Click this menu, the LCD will display the interface as shown in Figure 4-14. The panel display settings can be modified through this menu.

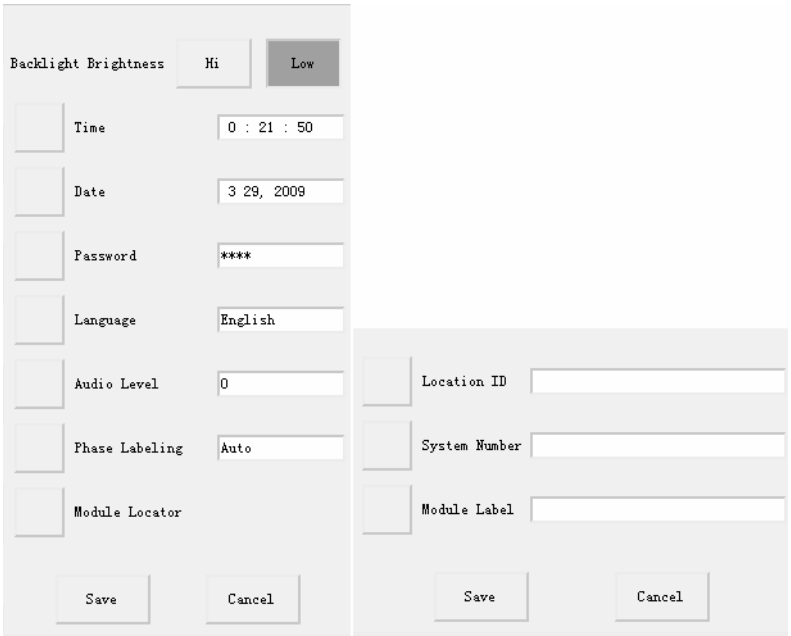


Fig.4- 14 System setting dialog

Backlight brightness —— High or low(default setting is low)

Time(24-hour system)——Hour, minute and second can be adjusted

Date(Format: Month/ Day/ Year)——Month, day and year can be adjusted

Password —— reset password (upper case and lower case are different for the password)

Language—— English, Chinese, French, Spanish, German, Italian, Portuguese (the display only supports Chinese, English)

Volume —— level 1 to level 10(default setting is level 5)

Phase marking ——Auto, ABC, RST, XYZ, RYB, RWB, UVW, 123 and L1L2L3 (default setting is Auto)

Machine position number

Position ID—— Both letter and number are acceptable

System number—— Both letter and number are acceptable

Module number—— Numbers(1 to 99)

Module label—— Both letter and number are acceptable

Settings that can be modified by user

The alarm settings can be modified through this menu and the following dialog will be popped (as shown in Figure 4-15):

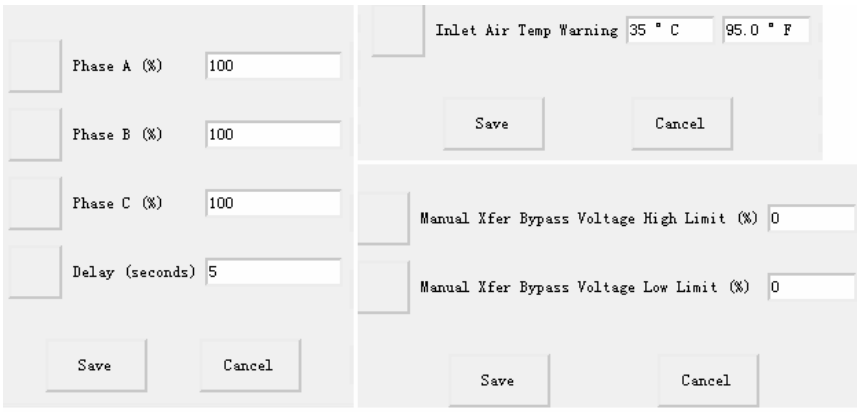


Fig.4- 15 Dialog for settings that can be modified by user

Maximum load alarm

Load percentage of output phase A—— settable from 10% to 105% (default setting is 95%)

Load percentage of output phase B—— settable from 10% to 105% (default setting is 95%)

Load percentage of output phase C ——settable from 10% to 105% (default setting is 95%)

Delay (second)—— settable from 0 to 60 (default setting is 5s)

Voltage limits for manually transfer to bypass

High voltage limit for manually transfer to bypass ——1% to 15%(default setting is 5%)

Low voltage limit for manually transfer to bypass ——1% to 20%(default setting is 5%)

Temperature alarm of air inlet port

Temperature alarm of air inlet port ——30ºC to 40 ºC (default setting is 35 ºC)

Note: the temperature has two units of ºC and ºF.

Battery management

The settings related to battery can be modified through this menu. The battery management dialog will be displayed as shown in Figure 4-16.

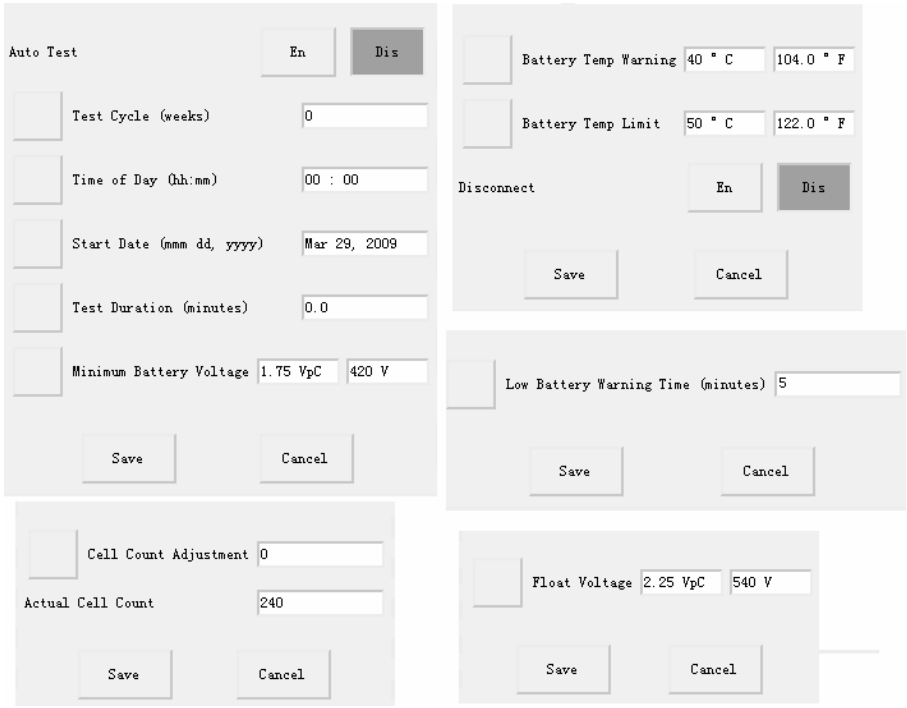


Fig.4- 16 battery management dialog

Battery equalize charge setting

Equalize charge voltage, voltage of each cell——2.3V to 2.45V (default setting is 2.3V)

Equalize charge time (hour)——0 to 200 hours(default setting is 1)

Warning
The equalize charge must be set to “enabled” through host computer. Otherwise this function cannot be used and this menu item will not be displayed. If the system is in equalize charge status, then the equalize charge time will be effective when the next equalize charge starts.

Battery test

Auto test——Enabled / disabled (default setting is “disabled”)

Test cycle (week)——1 to 26 weeks (default setting is 13)

Test time——Set hour and minute, and is used to set the battery auto test start time

Start date (month/day/year)——Set month/day/year, is used to set the start date of battery auto test

Continuous test time (minute)——0.5 minute to 30% total operating time (default setting is 0.5 minutes)

Minimum battery voltage (only for lead-acid battery)——1.75VPC (Voltage per Cell) to 1.95VPC (default setting is 1.75VPC); the test will stop when minimum voltage is reached.

Battery low voltage alarm time

Battery low voltage alarm time (minute)——2 to 120 minutes, dependent on the battery used (default setting is 5 minutes)

Battery temperature

Battery temperature alarm——30ºC to 50ºC (default setting is 40ºC)

Battery temperature limit——35ºC to 60ºC (default setting is 50ºC)

Disconnection——Enabled / disabled (default setting is “disabled”)

Note
If the battery disconnection is set to “enabled” and the battery temperature limit condition is met, the battery circuit breaker will open automatically.

Adjustment of battery cells

Adjustment of battery cells ——-12 cells to 6 cells (default setting is 0 cell)

Battery float charging voltage

Battery float charging voltage (V/cell)——2.15 to 2.3(default setting is 2.25)

Internal Optional Part Settings

The internal optional part settings can be modified through this menu.

Note
This function must be set to “enabled” through host computer. Otherwise this function cannot be used and this menu item will not be displayed.

The internal optional part setting includes the settings of input dry contact board and programmable relay board, and the setting dialog is as shown in Figure 4-17 and Figure 4-18 respectively.

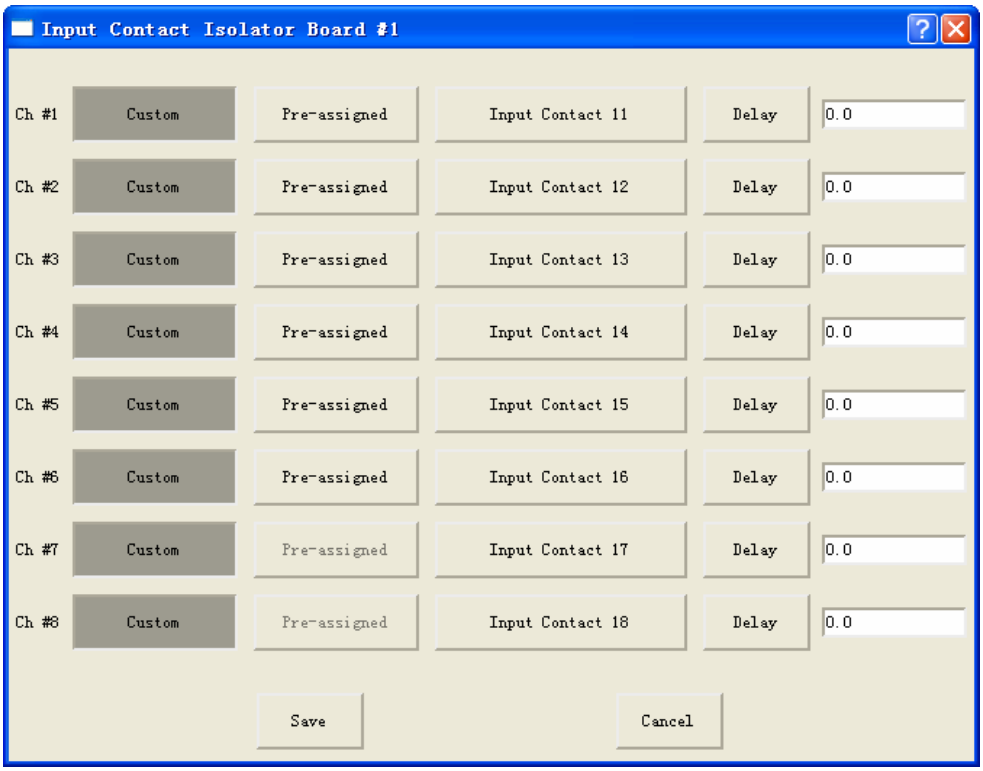


Fig.4- 17 Dialog for setting input dry contact board

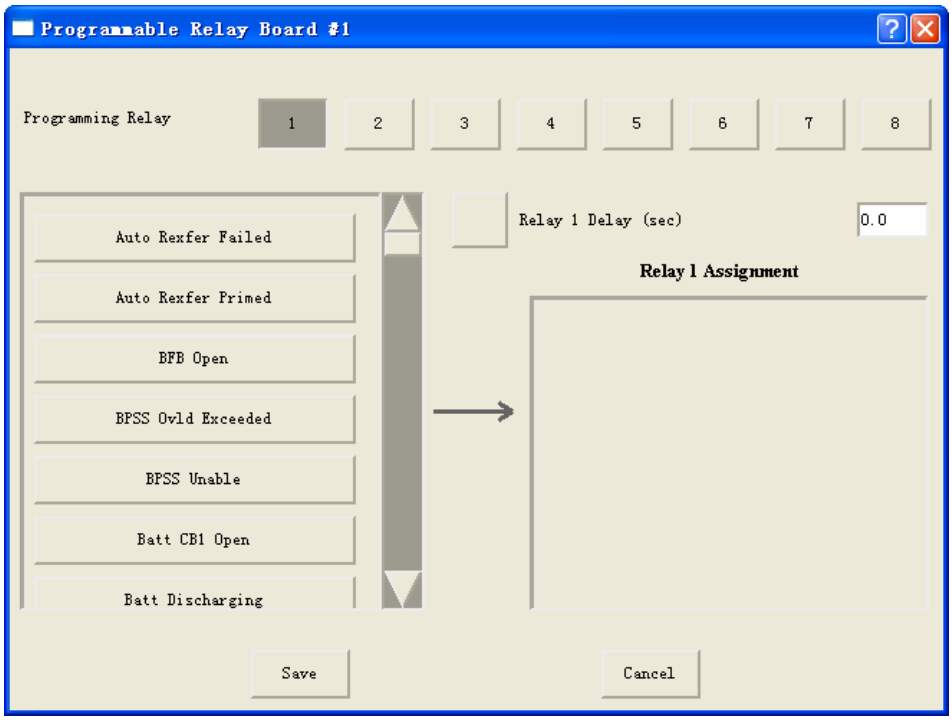


Fig.4- 18 Dialog for setting programmable relay board

input dry contact board

Setting—— Self-defined and pre-allocated (default setting is “disabled”)

Delay (second)——0 to 99.9 seconds (default setting is 0)

Message—— Self-defined: 0 to 19 characters

Programmable relay board

Setting——0 to 4 events (default setting is 0)

Delay (second)——0 to 99.9 seconds (default setting is 0)

Event management

The alarm, fault and status information processing method of the UPS can be modified by this menu as shown in Figure 4-19.

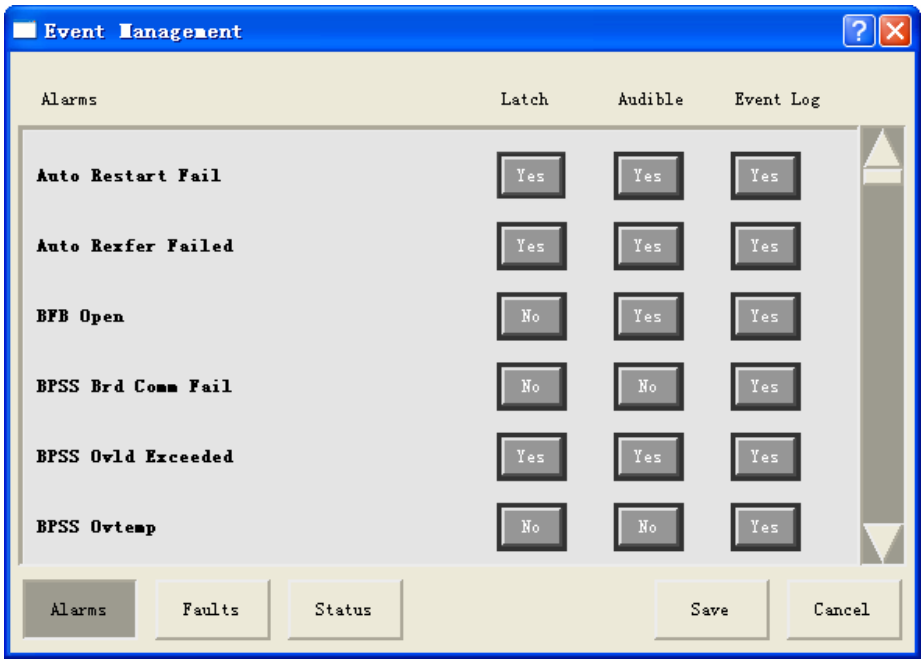


Fig.4- 19 Dialog for event management

Lock (Yes/No)——After the event is activated, the event is locked until user clears the event log even if the fault clearing event is still displayed in the screen.

Silence (Yes/No)——Whether the sound can be heard when an event happens.

Event log (Yes/No)——Whether the event will be displayed in event log when an event happens.

Status Report

This menu can be used to query all current and history event log.

Event log—— Be able to store 0 to 1024 events. When the number of events exceeds 1024, the oldest event will be deleted and replaced by the newest one.

The UPS event list is given in Table 4-3.

System Status

Total operating hours——The total number of operating hours of UPS

Battery operating hours——Total discharging time of battery, and the data will be saved until it is finally deleted from the event log.

Power-on

This menu can be used to start UPS, input Trap filter, MBD and BCB.

Manually power-on——It is used to turn on UPS, see *5.2 UPS Power-on Procedures (inverter mode)* for detailed procedures

Equipment control

Turn on Trap——If input Trap filter is installed, turn on Trap filter

Turn on MBD/BCB——If MBD is controlled electrically, turn on to enable it, it will be turned on through electrical control. If MBD is not controlled electrically, it has to be manually turned on. If MBD is not installed, it will not be displayed on the panel and only BCB is displayed.

Power-off

This menu can be used to turn off UPS, input Trap filter, MBD and BCB as shown in Figure 4-20.

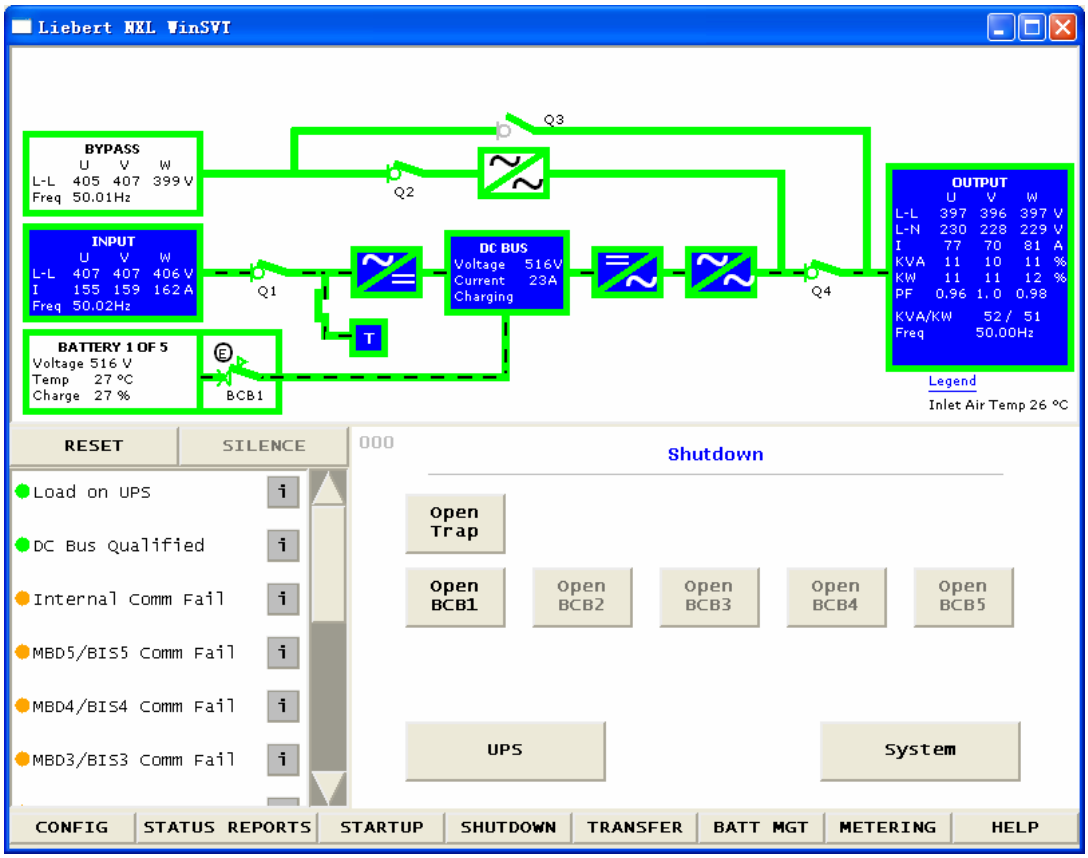


Fig.4- 20 Power off menu

Open Trap——Turn off input Trap filter

Open MBD/BCB——Turn off MBD or BCB

UPS——Turn off rectifier, inverter and battery circuit breaker. If the condition for transferring to bypass is met, the system will transfer to bypass.

Note
When powering off UPS, a dialog for confirmation will be popped up as shown in Figure 4-21. The UPS can only be shut down if you click the “OK” button.

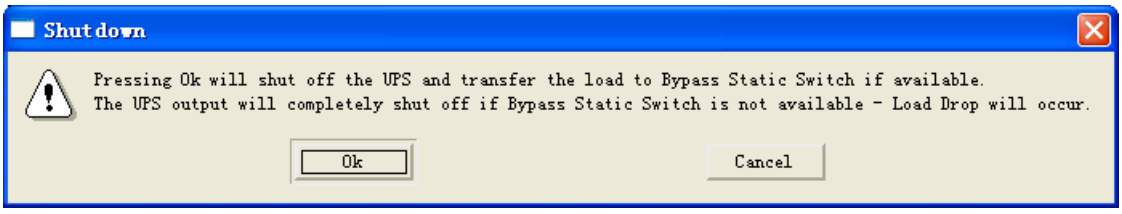


Fig.4- 21 Dialog for turning off UPS

System——Turning off rectifier, inverter and battery circuit breaker will completely shut down the system.

Note
This command will cause load power off. In order to avoid risk, a dialog will be popped up for confirmation, as shown in Figure 4-22. The system can only be shut down if you click the “OK” button.

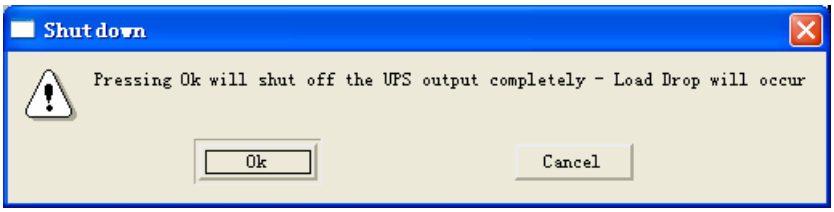


Fig.4- 212 Dialog for turning off system

Transfer

This menu enables the system to transfer between inverter mode and bypass mode. The window will display if the bypass is in the synchronization range of the UPS. If it is, press “Bypass”, the system will transfer to bypass mode and press “UPS”, the system will transfer back to inverter mode as shown in Figure 4-23.

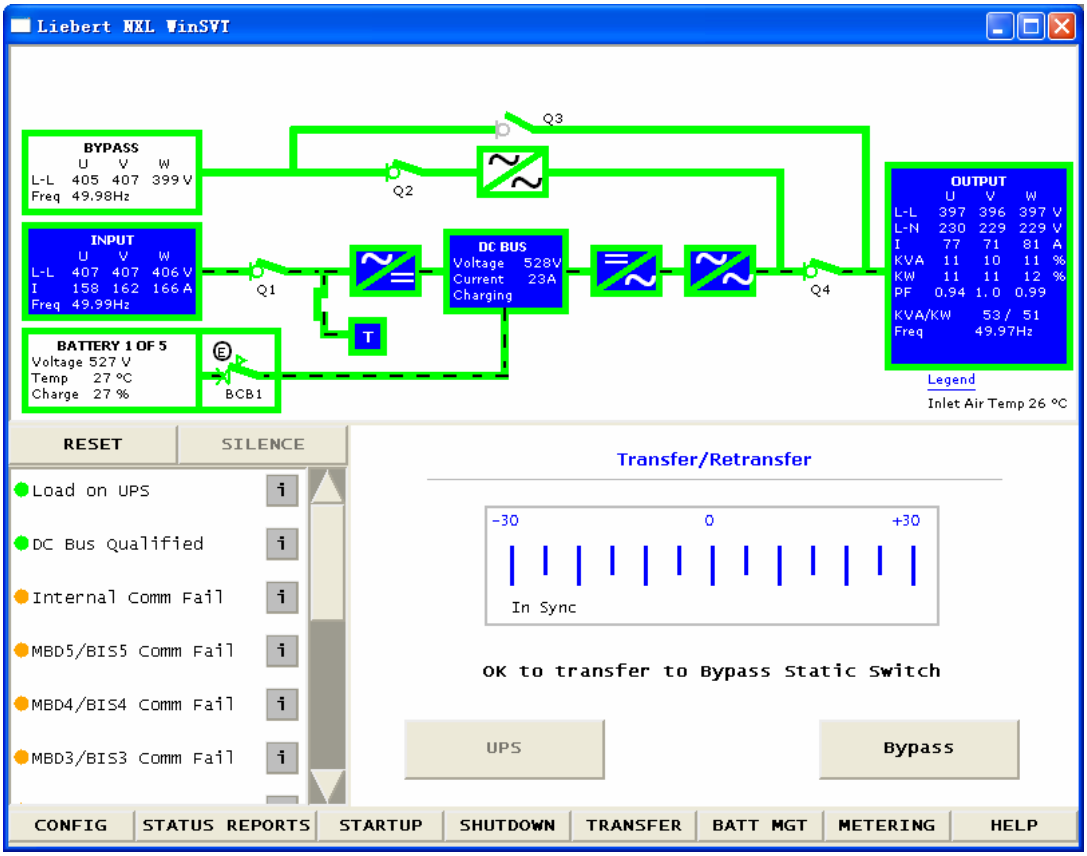


Fig.4- 223 Dialog for transfer/transfer back

Battery Management

This menu is used to modify the battery setting.

Battery remaining time curve——The remaining time curve is displayed in the window. The “battery voltage VS time” curve in some discharging process will be plotted (as shown in Figure 4-24).

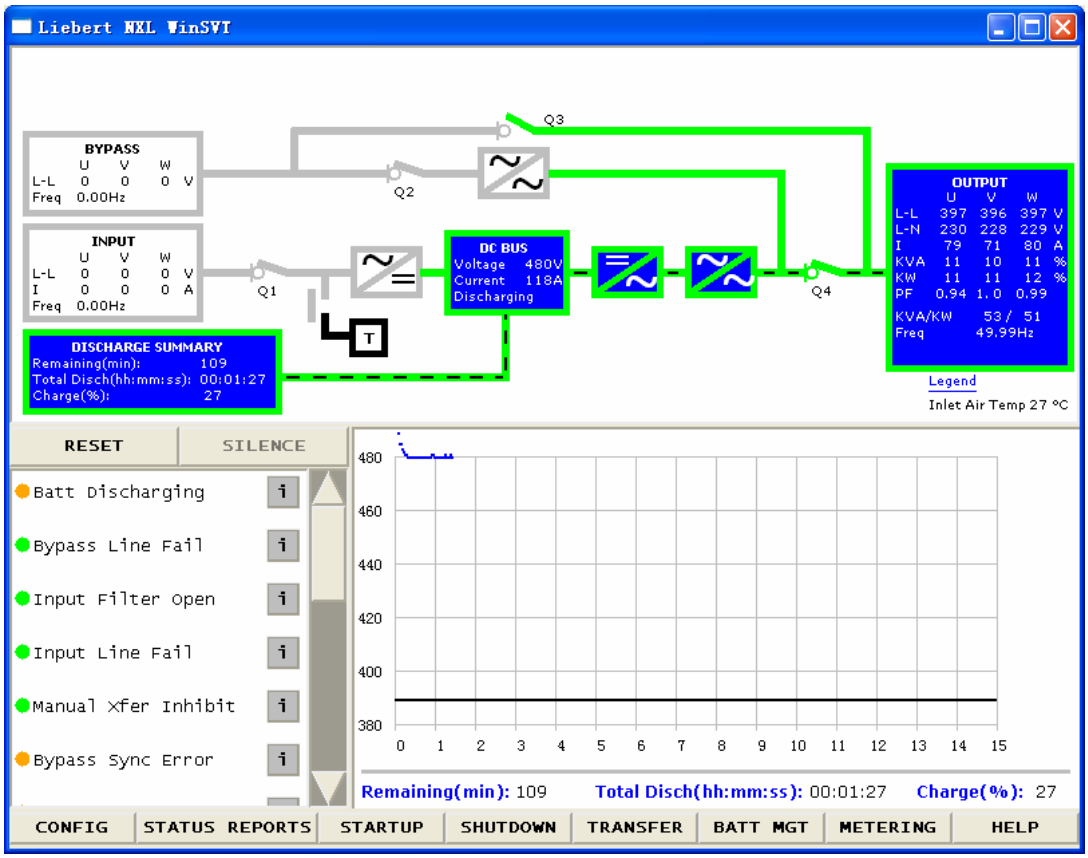


Fig.4- 234 Battery remaining time curve

Manual battery test——Start / Stop

Manual battery equalize charging—— Start / Stop equalize charging

Note
You cannot execute the manual equalize charging to the battery until the equalize charging function is enabled via host computer.

Battery cycle monitoring——Display the number of discharging processed in following time spans: 0 to 30 seconds, 31 to 90 seconds, 91 to 240 seconds, 4 to 15 minutes, 15 to 30 minutes, 30 to 60 minutes, 60 to 240 minutes, 4 to 8 hours, longer than 8 hours. The information of each discharging log includes:

#	Minimum active power
Date	Maximum active power
Time	AH (Ampere-hour) number
Continuous time	Start temperature ℃
Start active power	End temperature ℃

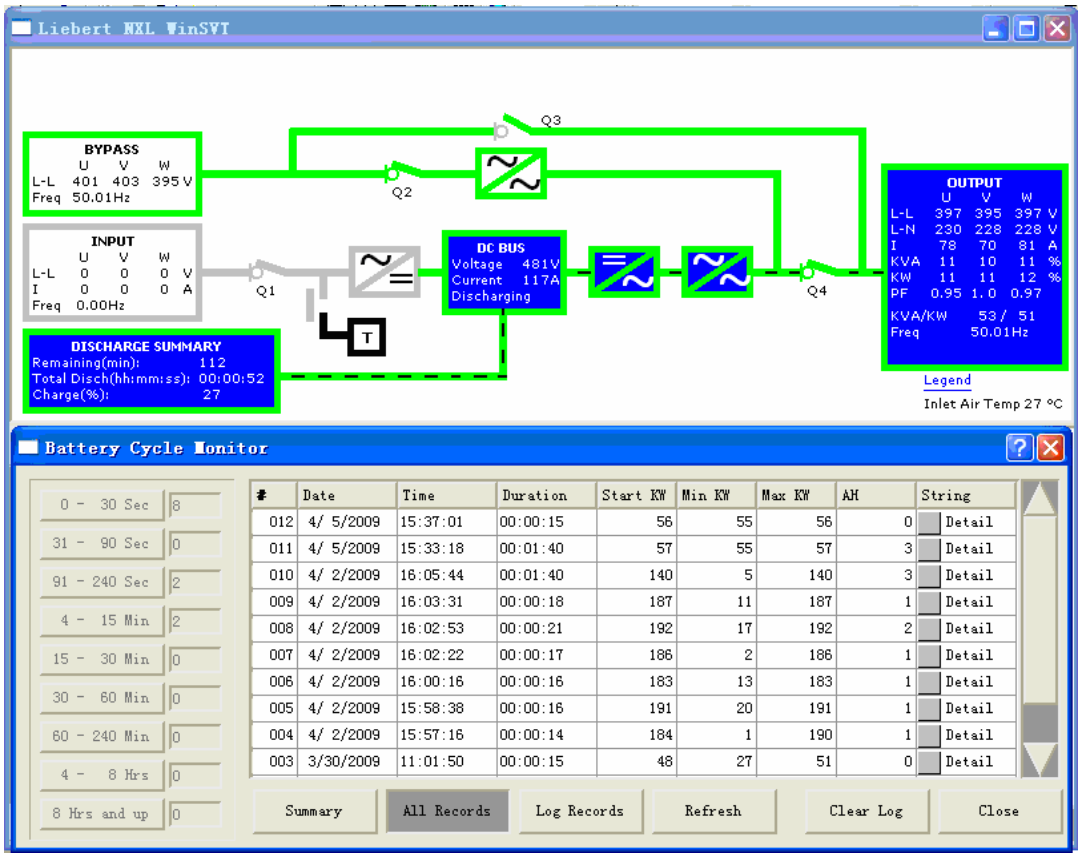


Fig.4- 245 Battery remaining time curve

Summary

As shown in Figure 4-26, using this menu can check the following information: Battery commission date / time, latest battery discharging date / time, activebattery discharging time, active battery AH (Ampere-hour) number, active battery capacity kW and total number of discharging times.

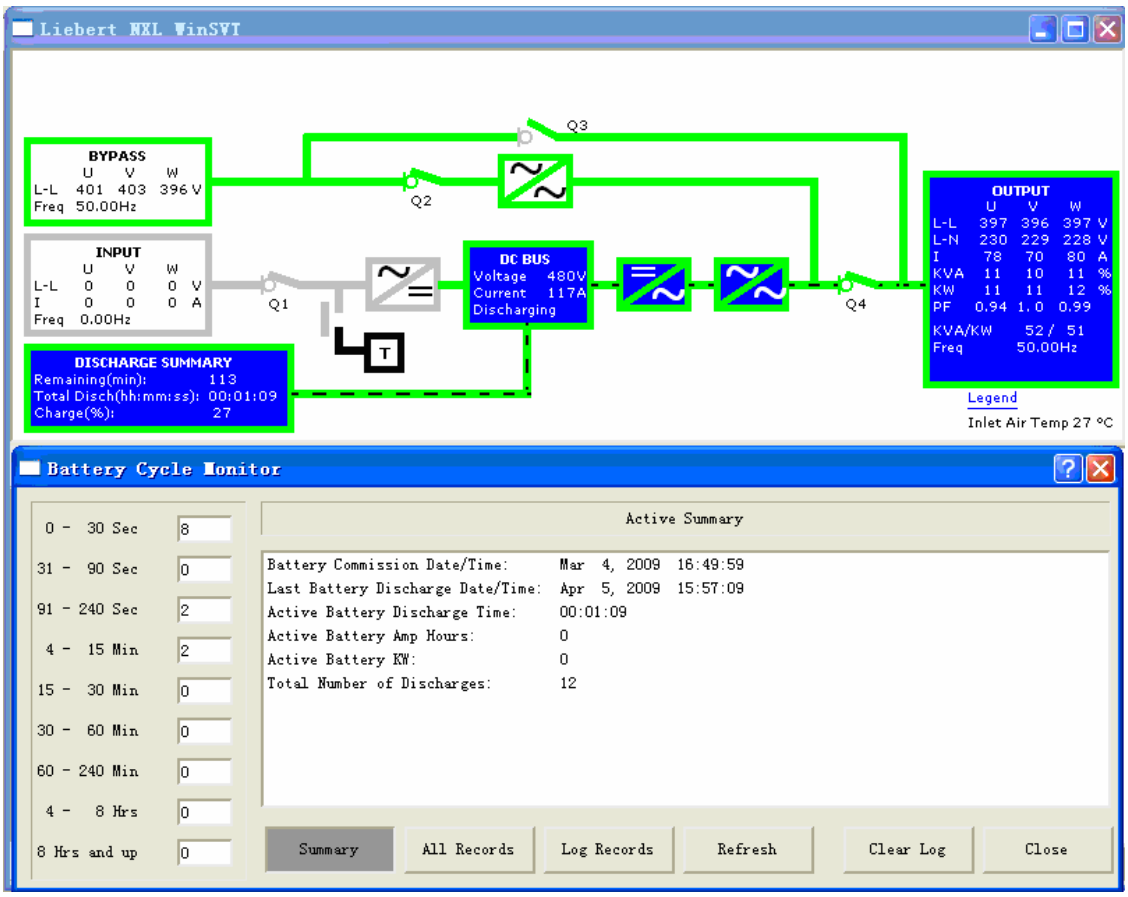


Fig.4- 256 Battery cycle monitoring summary

Clear log——This command will reset the first battery discharging date. A dialog will be popped up to warn the user that these data will be lost permanently and should be downloaded before the next operation step.

Measured Values

Click this menu, the screen will display relevant readings of the system parameters.

Help

Click this menu, the screen will display relevant the help information of the system.

Clear Event Log

Click this menu, the system will clear some locked events that have been ceased.

Alarm Silence

Click this menu, the alarm sound will be silenced.

EPO Button

There is an emergency power off (EPO) button on the front door of the UPS rectifier cabinet. This button is located at the right bottom part of the LCD control panel as shown in Figure 4-1 or Figure 4-2. This button is the LEPO button described in section *3.3.4 Emergency Power Off Input Button*. The button is housed underneath a safety cover to

prevent inadvertent operation. After the EPO button has been pressed, it disables the static switch block entirely (removing load power). It also disables the rectifier and inverter, and trips the battery circuit breaker. Under normal circumstances it does not remove UPS input power since this is applied through a manually controlled external circuit breaker, and you have to manually turn off the upstream input circuit breaker. If the UPS input supply is connected through a circuit breaker having an electrical trip facility, the EPO switch can be used to drive the external circuit breaker's trip circuit so as to remove the UPS input power.

If remote EPO is used, connect the wires according to descriptions of wiring in section *3.3.4 Emergency Power Off Input Button*.

UPS Event and Alarm List

The event messages of UPS are the system prompt, fault and alarm information. When the event happens, the current event window of HMI will display this event. After this event is ceased, this event will be recorded in "Event Log". The LCD panel function includes recording and browsing all kinds of event information. Table 4-3 provides the complete list of UPS events. The UPS uses colors to differentiate the severity of the events: The color for prompt event is green, that for alarm is orange and that for fault is red.

Table 4- 3 UPS Event Log

Prompt information	Meanings
Input Fault	Input mains power has fault, including input under voltage /over voltage, input over frequency / under frequency, input phase failure and input power failure.
Input Phase Failure	One or more than one input phase of the rectifier has no phase voltage. Check if any input wiring is missed or if the input wiring is damaged.
Input Reverse Phase Rotation	The rectifier input phase rotation is not A-B-C. Under normal condition, the rectifier input phase rotation is clockwise, that is, A-B-C. Phase B lags phase A by 120 degree and phase C lags phase B by 120 degrees. Power off the UPS and check if the rectifier input phase rotation is correct.
Input Under Voltage	The voltage of one or more than one input phase is less than a specified percentage value of rated voltage. Check the rectifier input voltage.
Input Over Voltage	The voltage of one or more than one input phase is higher than a specified rectifier input voltage, which results in the shutdown of rectifier. Check the rectifier input voltage.
Input OF/UF	Input frequency exceeds the rectifier input frequency range, which results in the shutdown of rectifier. Check the rectifier input frequency.
Input Current Limit	This alarm is triggered when input current RMS value reaches the input current limit or has exceeded the input current limit for some time. In generator mode, if the input current RMS value reaches the input current limit set in generator mode, the alarm of input current limit will also be triggered.
Input Current Imbalance	The difference between some phase current and the average current of three phases exceeds 25% due to the wrong operation of rectifier or input filter.
Rectifier Fault	The rectifier shuts down due to rectifier fault, including D/Y load sharing failure, bus voltage detection fault and rectifier synchronization failure.
D/Y Input Current Imbalance	When the rectified DC currents of two rectifiers has a difference of 8%, and input power reaches 60% of rated power, this alarm will be triggered.
Rectifier Synchronization Loss	After the rectifier starts up, the input cross-current point of the rectifier is abnormal.
Bypass Fault	Bypass input power failure including bypass synchronization error, bypass over voltage, under voltage, bypass phase rotation fault and bypass no voltage input.
Bypass Line Fail	The RMS value of bypass input line-to-line voltage is less than 30V.
Bypass Synchronization Error	The Phase angle of inverter differs from that of bypass by a certain degree. Transfer to bypass is prohibited.
Bypass Overvoltage	The line-to-line voltage RMS value of one or more than one input phase of bypass is higher than the rated line-to-line voltage by a certain percentage, which results in bypass shuts down.
Bypass Undervoltage	The line-to-line voltage RMS value of one or more than one input phase of bypass is lower than the rated line-to-line voltage by a certain percentage, which results in bypass shuts down.
Manual Transfer Inhibit	This event means the condition for manual transfer to bypass is not met (the inverter must synchronize with the bypass).
Man Re-transfer Inhibit	This event means the condition for manual re-transfer to inverter is not met (the inverter must synchronize with the bypass).
Bypass Overload	When UPS works on bypass, phase A has overload, that us, bypass phase A current RMS value is

Prompt information	Meanings
Phase A	greater than 110% rated current.If the overload cannot be cleared within a specified time, the control unit will shut down the system. The length of this time is reverse proportional to the amplitude of overload. For example, the higher amplitude of the overload, the shorter the time.
Bypass Overload Phase B	When UPS works on bypass, phase A has overload, that us, bypass phase B current RMS value is greater than 110% rated current. If the overload cannot be cleared within a specified time, the control unit will shut down the system. The length of this time is reverse proportional to the amplitude of overload. For example, the higher amplitude of the overload, the shorter the time.
Bypass Overload Phase C	When UPS works on bypass, phase C has overload, that us, bypass phase C current RMS value is greater than 110% rated current. If the overload cannot be cleared within a specified time, the control unit will shut down the system. The length of this time is reverse proportional to the amplitude of overload. For example, the higher amplitude of the overload, the shorter the time.
Bypass OF/UF	Bypass frequency exceeds the synchronization frequency range of inverter.
Bypass Reverse Phase Rotation	Under normal condition, the bypass input phase rotation is clockwise, that is, A-B-C. Phase B lags phase A by 120 degree and phase C lags phase B by 120 degrees. Power off the UPS and check if the bypass input phase rotation is correct. Correct the wrong phase rotation.
Auto Re-transfer Primed	Under current condition, auto re-transfer has the priority.
Auto Re-transfer Failure	The condition that causes failure of auto transfer to bypass has not been cleared in specified time.
Excess Auto Re-transfer	The number of auto re-transfer times in recent hours exceed the permitted maximum value.
Transfer to Inverter Inhibit	External signal prohibits the load to transfer from bypass to inverter.
Low Battery Warning	The calculated battery remaining time reaches the low battery alarm value and the UPS will shut down..
Low Battery Shutdown	The battery voltage is lower than EOD, which leads to shutdown. The battery capacity is inadequate to power the inverter..If the bypass is available, when the battery voltage reaches EOD, the UPS will try to transfer to bypass.
Low Battery Capacity	This alarm means the system contains several battery strings. At least one battery circuit breaker is closed and at least one battery circuit breaker is opened.
Battery Discharging	UPS is working in battery mode and the battery is discharging.
Battery Over-temp Warning	The battery temperature sensor reports battery temperature exceeds alarm limit. Check battery temperature and ventilation.
Battery X Over-temp Limit	Temperature of battery X reaches the alarm limit of battery temperature. If the BCB tripping is enabled, the BCB will trip after over temperature. Check battery temperature and ventilation.Note: “X” means the number of the battery cabinet / battery string and it ranges from 1 to 8.
DC Bus Over Voltage Transient	This alarm is triggered when the bus voltage is higher than the rated voltage by a certain percentage, or bypass SCR has short circuit fault. In the mean time the battery circuit breaker opens.
DC Bus Qualified	All the parameters of bus are within the allowed range of rectifier and inverter.
Inverter Fault	The inverter shuts down due to fault. The fault includes bus transient over voltage, inverter over voltage, inverter under voltage, inverter IGBT-A fault, inverter IGBT-B fault, inverter IGBT-C fault, DC bus over current IDC peak value fault and inverter sensor fault.
Inverter Current Limit	Inverter current reaches the limit.
Inverter Over voltage	This alarm is triggered when inverter output transient voltage exceeds 125% of rated voltage for 1 second, or bypass SCR has short circuit fault. This fault will result in inverter shutdown, and if the inverter is shut down, the UPS transfers to bypass.
Inverter Under Voltage	This alarm is triggered at non inverter current limiting status, non soft start when inverter output voltage transient value is lower than the rated voltage by 75% for 1 second, or bypass SCR has short circuit fault. This fault will result in inverter shutdown, and if the inverter is shut down, the UPS transfers to bypass.
Inverter Overload Phase A	Phase A is overload when inverter is operating, that is, the phase A RMS current value is higher than 105% of rated current RMS value or phase A output power is higher than 105% rated output power. When this alarm happens, a countdown timer will be displayed on the power flow diagram to display the remaining time for transfering to bypass. The length of the remaining time is proportional to the severity of the overload.
Inverter Overload Phase B	Phase B is overload when inverter is operating, that is, the phase B RMS current value is higher than 105% of rated current RMS value or phase B output power is higher than 105% rated output power. When this alarm happens, a countdown timer will be displayed on the power flow diagram to display the remaining time for transfering to bypass. The length of the remaining time is proportional to the

Prompt information	Meanings
	severity of the overload.
Inverter Overload Phase C	Phase C is overload when inverter is operating, that is, the phase C RMS current value is higher than 105% of rated current RMS value or phase C output power is higher than 105% rated output power. When this alarm happens, a countdown timer will be displayed on the power flow diagram to display the remaining time for transfering to bypass. The length of the remaining time is proportional to the severity of the overload.
Inverter Overload Time Exceeded	This information means at least one phase has overload. When the overload happens, a countdown timer will be displayed on the HMI to display the remaining time for transfering to bypass. The length of the remaining time is proportional to the severity of the overload. If the timer reaches 0, the UPS will transfer to bypass if the bypass is available, and this alarm will enter the active event window.
Inverter Phase A IGBT Fault	The system detects IGBT A fault, and IGBT phase A short circuit is one of the reasons for the alarm. This will result in the shutdown of rectifier and inverter, and if the shutdown is allowed, the UPS transfers to bypass.
Inverter Phase B IGBT Fault	The system detects IGBT B fault, and IGBT phase B short circuit is one of the reasons for the alarm. This will result in the shutdown of rectifier and inverter, and if the shutdown is allowed, the UPS transfers to bypass.
Inverter Phase C IGBT Fault	The system detects IGBT C fault, and IGBT phase C short circuit is one of the reasons for the alarm. This will result in the shutdown of rectifier and inverter, and if the shutdown is allowed, the UPS transfers to bypass.
Output Fault	UPS output has fault including output over frequency / under frequency, and output over voltage / under voltage.
Output OF/UF	Output frequency exceeds the allowed rated frequency range.
Output Over Voltage	This alarm is triggered when the output voltage exceeds the high limit for some time (the time is determined by the over voltage value), or inverter SCR is opened or bypass SCR has short circuit fault. This fault will result in inverter shutdown, and if the shutdown is allowed, the UPS transfers to bypass.
Output Under Voltage	This alarm is triggered when the output voltage is lower than the low limit for some time (the time is determined by the under voltage value), or inverter SCR is opened or bypass SCR has short circuit fault. This fault will result in inverter shutdown, and if the shutdown is allowed, the UPS transfers to bypass.
Fan X Fault	The fan X has faults. Note: “X” means the fan number of 1~32.
Manual transfer to Bypass	The system is manually transferred to bypass.
Manual transfer to Inverter	The system is manually transferred to inverter.
Trap Fuse Fail	If the module is installed with input filter, the fuse of one or more than one filter has fault.
Output Fuse Fail	One or more than one output fuse has fault.
HF Filter Fuse Fail	The fuse of Grass Filter fails.
Load on UPS	The load power comes from the inverter and the UPS operates in normal mode.
Load on Bypass	The load power comes from the bypass and the UPS operates in bypass mode.
Load on Maintenance Bypass	The load power comes from the maintenance bypass and the UPS operates in maintenance bypass mode.
Low Power Factor	The load power factor is lower than the rated low value at maximum load. For a certain kind of load, the UPS output current will be increased with the decrease of power factor, which requires the UPS output power to be derated.
BFB open	BFB is opened.
CB3 Open Fail	Bypass circuit breaker cannot be opened.
CB3 Close Fail	Bypass circuit breaker cannot be closed.
CB2 Close Fail	Inverter output circuit breaker cannot be closed.
CB2 Trip Fail	Inverter output circuit breaker does not respond to the open signal.
Pulse Paralleling	The bypass SCR is on for a short time to help the inverter to power the load.
Transfer to Bypass Failed	One event (such as inverter fault) results in the automatic system’s transfer to bypass but the transfer fails.
On Generator Active	The generator powers the system.
Rectifier Off Input Low	Rectifier is shut down because one phase or multi-phase input voltage is low. Check the input voltage.
Input Line Fail	Power supply input has fault that results in the rectifier shutdown. Check the input voltage.
Event Log Clear	Event log is cleared.
Bypass/Output Phase Error	The phase difference between bypass and output is wrong and is bigger than 16 degrees.

Prompt information	Meanings
Battery Equalizing	Battery status (battery is in equalize charging status)
Battery Commissioning	The rectifier output voltage setting (bus voltage) is increased to the commissioning voltage level.
Battery Self Test	UPS performs battery self test.
PRB1 **Communication Fail**	Timed communication failure of PRB1 board
PRB2 **Communication Fail**	Timed communication failure of PRB2 board
EPO Shutdown	EPO command is detected, the UPS is shut down in emergency. If EPO button is pressed manually, this alarm is triggered. This fault cannot be recovered.
REPO Shutdown	Remote EPO command is detected. This alarm happens if the REPO button is pressed. This fault cannot be recovered.
Battery Detection X Fail	Battery temperature sensor X detects that the temperature data is outside of normal range, for example, high or low temperature is detected or the temperature change within 1 second is too big.Note: “X” means the battery temperature sensor number 1 to 8.
Battery Sensor Fail	Among group 1 to group 8 battery temperature sensors, at least one group detects abnormal data.
Battery Temp Imbalance	Battery temperature sensor detects the battery string temperature different is bigger than 5ºC.
Battery Test Fail	Auto or manual battery test fails. The battery “continuous test time” is adjustable. Before the battery continuous test time is over, the criteria for judging the battery test failure is triggered.
Battery Test Passed	Battery test is passed.
Inverter Backfeed	This alarm is triggered when the inverter is turned on, the inverter power flow is detected reversed and the reverse power flow is higher than a certain value for some time. The bypass SCR short circuit can also trigger this alarm.
Redundant Fan Fail	This alarm means some fan has failed.
FIB 1 Communication Fail	FIB1 (fan interface board 1) communication fails.
FIB 2 Communication Fail	FIB2 (fan interface board 2) communication fails.
FIB 3 Communication Fail	FIB3 (fan interface board 3) communication fails.
FIB 4 Communication Fail	FIB4 (fan interface board 4) communication fails.
Configuration Modified	User makes modifications to one or more than one configuration items in configuration menu and save the modifications.
User Shutdown	User shuts down the inverter or system.
User Startup Initialization	User issues the manual or auto power on command from the interface of “Start / Shut down”.
DC Fuse Fail	Inverter DC input fuse is opened.
Input P/S Fail	Input auxiliary power supply fails but UPS still operates normally.
Bypass P/S Fail	Bypass auxiliary power supply fails but UPS still operates normally.
DC P/S Fail	Bus auxiliary power supply fails but UPS still operates normally.
Option P/S Fail	Optional auxiliary power supply fails but UPS still operates normally.
Output P/S Fail	Output auxiliary power supply fails but UPS still operates normally.
EPO P/S Fail	EPO auxiliary power supply fails but UPS still operates normally.
Power Supply Fail	Auxiliary power supply fails
BFB Trip Signaled	BFB receives tripping signal.
BFB Open Fail	BFB does not open after receiving the tripping signal.
CB1 Open Fail	Rectifier input circuit breaker does not open after receiving the tripping signal.
CB1 Close Fail	Rectifier input circuit breaker does not close after receiving the closing signal.
Battery CBX Open Fail	Battery circuit breaker X (MBD/BIS/BCB) does not open after receiving the tripping signal.Note: “X” means the battery circuit breaker (MBD/BIS/BCB) 1 to 5. BIS: When there is no MBD, BCB is BIS
Batt CBX Close Fail	Battery circuit breaker X (MBD/BIS/BCB) does not respond to close signal. Note: “X” means the battery circuit breaker (MBD/BIS/BCB) 1 to 5.
Batt CBX Open	Status of battery circuit breaker X (open) Note: “X” means the battery circuit breaker (BIS) 1 to 8.
Inlet Over-temp	UPS module air inlet temperature exceeds the preset highest value. UPS only alarms but does not act upon this.
Outlet Over-temp	Difference between temperature of air outlet port and that of air inlet port exceeds the specified maximum temperature difference. This fault will result in inverter shutdown, and if the shutdown is

Prompt information	Meanings
	allowed, the UPS transfers to bypass.
Equip Over-temp	This event means the UPS is close to the over temperature limit including the rectifier over temperature, BPSS over temperature, inverter over temperature, and ISS over temperature. UPS only alarms but does not perform protective actions.

Prompt information	Meanings
Equip Over-temp Limit	This event means the temperature of one or more parts in the UPS exceeds the maximum temperature limit setting including rectifier over temperature limit, BPSS over temperature limit, inverter over temperature limit, and ISS over temperature limit.
Rectifier Over-temp	The temperature of rectifier's semiconductor heatsink exceeds the stable temperature. UPS only alarms but does not perform protective actions.
Rectifier Over-temp Limit	The temperature of rectifier's semiconductor heatsink exceeds the maximum temperature limit. The rectifier will shut down. If allowed, the UPS will transfer to battery or bypass.
Aux Over-temp	The temperature of auxiliary temperature sensor exceeds the stable temperature.
Inv Over-temp	The temperature of inverter's semiconductor heatsink exceeds the stable temperature. UPS only alarms but does not perform protective actions.
Inv Over-temp Limit	The temperature of inverter's semiconductor heatsink exceeds the maximum temperature limit. This fault will result in inverter shutdown, and if the shutdown is allowed, the UPS transfers to bypass.
Temp Sense Fail	The temperature detected by temperature sensor exceeds the measurement range of the sensor. For example, the detected temperature is too high or too low, or the temperature difference within 1s is too big.
Excess Paralleling	The fault status means there are too many paralleling pulse numbers, now the UPS is locked in bypass mode (auto transfer to inverter is prohibited).
Main Control Fault	Main controller has faults.
DSP Comm Failure	The communication between the controller DSP and system DSP fails.
Control DSP Failure	The controller DSP has fault.
Battery Protect	When the event of low battery voltage happens, the system prevents the battery (lead acid) from deep discharge.
BPSS Board Comm Fail	Bypass static switch has fault.
Battery Log Cleared	The event log of battery discharge is cleared.
Battery Cycle Log Full	The battery cycle log is full.
Battery Over-temp Limit	The temperature detected by the battery temperature sensor exceeds the setting.
Password Changed	User password is changed.
CB3 Open	Status of bypass circuit breaker CB3 (open)
SW1 Open	Status of bypass circuit breaker SW1 (open)
CB1 Open	Status of rectifier input circuit breaker CB1 (open)
CB2 Open	Status of output circuit breaker CB2 is opened.
MBB Open	Status of maintenance bypass circuit breaker MBB (open)
MIB Open	Status of maintenance isolation circuit breaker MIB (open)
MBDX/BISX Communication Fail	MBDX/BISX timed communication failureNote: "X" means the number of MBD or BIS 1 to 5.
BISX Communication Fail	BIS communication failure Note: "X" means the number of BIS 6 to 8.
EIB Comm Fail	EIB timed communication failure
Q2 Open	Status of bypass circuit breaker Q2 (open)
Q3 Open	Status of maintenance bypass circuit breaker Q3 (open)
Q4 Open	Status of output circuit breaker Q4 (open)
Q11 Open	Status of external rectifier input isolation breaker Q11 (open)
Q22 Open	Status of bypass isolation breaker Q22 (open)
QBP Open	Status of external maintenance bypass isolation breaker QBP (open)
Q1 Open	Status of rectifier input circuit breaker Q1 (open)
QOP Open	Status of external output isolation breaker QOP (open).
Batt Test Stopped	Battery test is stopped.
Batt Test Inhibit	Battery test is inhibited.
RIB Open	Status of rectifier input circuit breaker RIB (open)
BIB Open	Status of bypass isolation circuit breaker BIB (open)
MBD/BCB Comm Fail	MBD/BCB timed communication failure
Input Dry Contact X	Input contact isolation board is triggered by external contact signal. Reserved for user. Alarm information can be defined by user. Refer to *1.1.1 Internal Optional Parts Setting*Note: "X" means the number of dry contacts 11~18 and 21~28.
Remote Off Rect	The rectifier is shut down by external contact signal.This status means that the external contact signal

Prompt information	Meanings
	that shuts down the rectifier is enabled. This kind of signal is connected to the input dry contact board and one of the channels is defined to remotely shut down the rectifier.
Remote Off Inv	The inverter is shut down by external contact signal. This status means that the external contact signal that shuts down the inverter is enabled. This kind of signal is connected to the input dry contact board and one of the channels is defined to remotely shut down the inverter.
MBD/BCB Open Fail	MBD/BCB cannot be opened.
MBD/BCB Close Fail	MBD/BCB cannot be closed.
MBD/BCB Open	Status of MBD/BCB circuit breaker (open)
Batt Not Charging	Battery status is uncharged.
HMI Comm Fail	Timed communication failure of HMI
ICI#1 Comm Fail	ICI#1 communication failure
ICI#2 Comm Fail	ICI#2 communication failure
Internal Comm Fail	Communication failure of internal bus in control board
Fuse Fail	The fuse has fault, which means at least one fuse among the fuse of input filter, the fuse of output filter, the rectifier fuse, the inverter fuse, the fuse of high frequency filter and the output fuse of the system has fault.
Controller Error	The controller has fault.
Breaker Open Fail	This fault is a general event, which means the system orders that one circuit breaker should be opened or should be opened manually, but the circuit breaker fails to report the open status.
Breaker Close Fail	This fault is a general event, which means the system orders that one circuit breaker should be closed or should be closed manually, but the circuit breaker fails to report the closed status.
Input Filter Cycle	Input filter is opened and closed automatically for 9 times within one hour and after that, it cannot be automatically opened and closed any more.
Stop Chrg Batt OT	The detected battery temperature exceeds the setting, so the battery charging is stopped.
Multiple Fan Fail	This event means more than one fan in the system fail.
Out Filter Fuse Fail	One or more than one fuse in output filter fails.
Batt Ground Fault	The detected battery current exceeds the tripping value.
Auto Restart Fail	Auto restart is enabled but fails. Reasons: Manual shutdown in auto restart, or bypass source or rectifier source is abnormal in auto restart process, or the bus voltage does not meet the requirement for starting inverter, or the system cannot transfer to rectifier circuit to power the load. All these reasons will trigger this alarm.
Restart Inhibited	When the signal from the input dry contact board is enabled, the auto restart function will be disabled.
Restart In Process	Auto start is in process. The manual startup is prohibited at this time.
EMO Shutdown	The system detects module emergent power-off command (EMO).
Q33 Open	Status of external bypass circuit breaker Q33 (open)
User Event Reset	User has executed the event clearing operation.
IDC Peak Fault	The system detects IDC peak value fault IGBT short circuit fault or bypass SCR fault, and all these kinds of faults will trigger this alarm.
SERVICE CODE ACTIVE	This event is used for the purpose of information and is to tell the user that the service code is valid.
LBS Inhibited	The LBS operation conditions cannot be met when LBS operation is enabled.
Regen Active	This status tells user that the UPS is in regenerative mode.
Regen Terminated	This status tells user that the UPS is not in regenerative mode. The regenerative time is out or is stopped manually..
Regen Failure	The regenerative mode starts or stops under abnormal conditions.
Leading Power Factor	The leading power factor may result in energy waste. If power factor is less than 0.95, UPS output power will be derated to compensate the output power loss.
BPSS Overload Exceeded	The bypass static switch is closed due to continuous overload.
BPSS Unable	The bypass static switch cannot be operated in normal mode.
BPSS Open	When the system turns on the bypass, the SCR in one or more than one phase of the bypass is opened.
BPSS SCR Shorted	One or more than one SCR has short circuit fault. This fault may be missed for being reported.
BPSS Over-temp	The temperature of bypass static switch heatsink exceeds the stable temperature. UPS only alarms but does not perform protective actions
BPSS Over-temp Limit	The temperature of bypass static switch heatsink exceeds the maximum temperature limit. The bypass can be enabled /disabled through the software programming in host computer.
Remote Off BPSS	The bypass static switch is closed by external contact signal. This status means that the external

Prompt information	Meanings
	contact signal that shuts down the BPSS is enabled. This kind of signal is connected to the input dry contact board and one of the channels is defined to remotely shut down the BPSS.
Vdc Sense Fail	The system detects the error in the detection of DC bus voltage. If the difference of the DC bus voltage detected in different time is too big, this alarm will be triggered.
Controls Reset Req	This alarm means one or more than one setting is modified in the UPS operating process. The system can reset through power off or pressing the reset button on the UPSC board.
ISS SCR Shorted	The inverter is not turned on and the output circuit breaker is not closed. When the fuse is normal, the system detects that the inverter side voltage of inverter static switch is higher than the rated voltage by a certain percentage, so this alarm is triggered.
ISS Over-temp	The temperature of output static switch heatsink exceeds the stable temperature. UPS only alarms but does not perform protective actions.
ISS Over-temp Limit	The temperature of output static switch heatsink exceeds the maximum temperature limit. This fault will result in inverter shutdown, and if the shutdown is allowed, the UPS transfers to bypass.
Input Filter Open	Input filter is opened.
Inverter Sense Fail	If the sum of the transient values of three phase currents exceeds one threshold, the inverter sensor fails because the sum of the transient values of three phase currents should be zero in principle.
Controls Comm Fail	The communication between the control system DSP and external device fails.
Rectifier Fuse Fail	One or more than one fuse in the rectifier fails.
Max Load Exceeded Ph A	The load exceeds the maximum load alarm value of phase A. This alarm value can be set by user through HMI and the alarm detecting delay time can also be set.
Max Load Exceeded Ph B	The load exceeds the maximum load alarm value of phase B. This alarm value can be set by user through HMI and the alarm detecting delay time can also be set.
Max Load Exceeded Ph C	The load exceeds the maximum load alarm value of phase C. This alarm value can be set by user through HMI and the alarm detecting delay time can also be set.
LBS Active	LBS is enabled and is active.

5. Operating Instructions

This chapter provides detailed operating notes and routine operating instructions of the HIPULSE-NXL 500/800kVA UPS.

Introduction

Notes


Important

Only after an authorized engineer has conducted the first-time power-on and completed the UPS commissioning is the user allowed to operate the UPS.
Components behind inner doors, which require a tool to remove, is not accessable for users. Only qualified service personnel are authorised to open inner doors.
Hazardous voltages are always present at the UPS input and output terminals. If the UPS is fitted with an internal EMC filter, the filter carries hazardous voltages too.

1. All the operator control and display panel, the buttons and power switches mentioned in these procedures are described in *Chapter 4 Operator Control And Display Panel*.

2. The UPS system incorporates an optional automatic boost charge facility, which can be used in systems containing conventional lead-acid batteries. If this type of battery is used in your installation you may notice that the battery charger voltage may be greater than its normal charging voltage (that is 540V) when the mains supply returns from a prolonged outage. This is the normal response, and the charger voltage should return to normal after a few hours.

Power Switches

The power switches, mounted inside the UPS cabinet are accessible after opening the front door with a key. The location of the UPS power switches is shown in Figure 5-1 and Figure 5-2, which includes:

Q1 — input switch: Connects the UPS with the mains supply.

Q2 — bypass switch: Connects the UPS with the bypass supply.

Q3 — maintenance bypass switch (locked): The load directly powered by the maintenance bypass line during the maintenance process of the UPS module.

The internal maintenance bypass must not be used when the UPS system has more than two UPS modules in parallel.

Q4 — output switch: Connects the output of the UPS to the load.

Note: The battery circuit breaker is not expected inside of the UPS and should be installed in the proximity of the respective battery. Figure 5-1 and Figure 5-2 show the view of the 500/800kVA UPS after front door is removed.

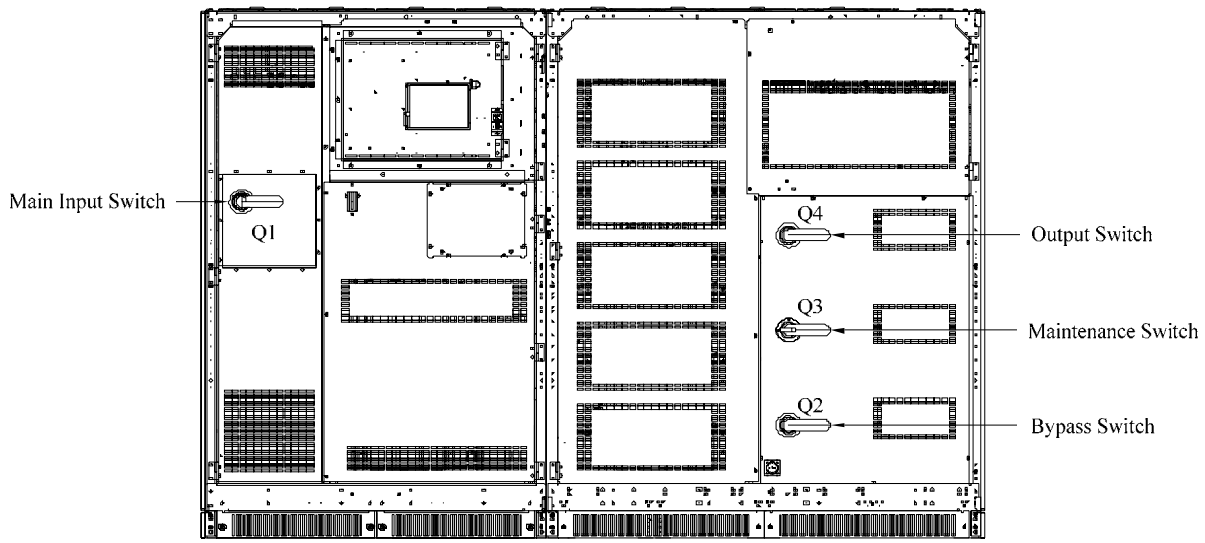


Fig.5- 1 Power switch locations of 500kVA UPS

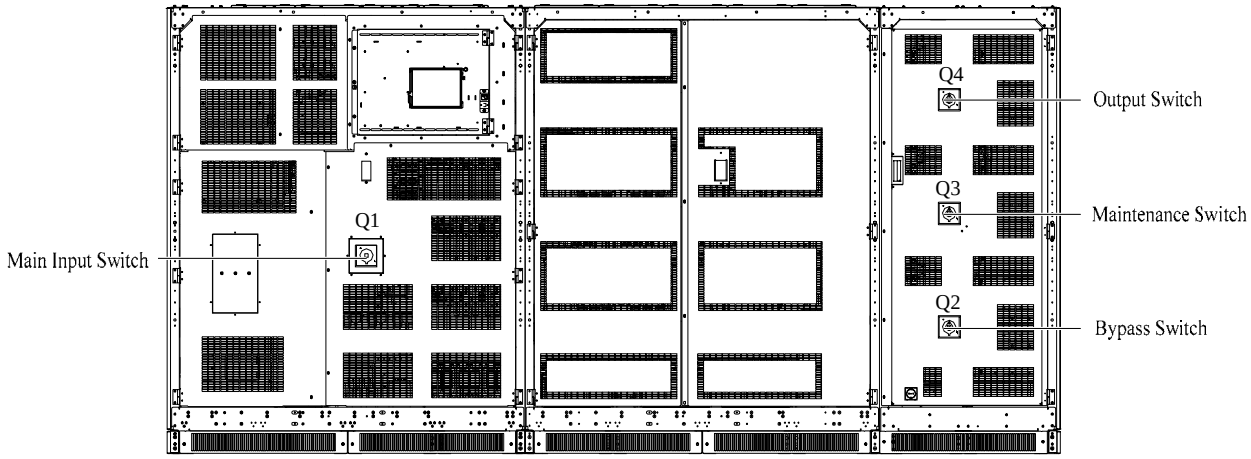


Fig.5- 2 Power switch locations of 800kVA UPS

Start-Up Procedure (Into Normal Mode)

This procedure must be followed when turning on the UPS from a fully powered down condition, that is, where the load is not being initially supplied at all or where supplied by the maintenance bypass switch. It is assumed that the installation is complete, the system has been commissioned by authorized personnel and the external power isolators are closed.

 Warning – Mains voltage will be applied to UPS output terminals
This procedure results in mains voltage being applied to the UPS output terminals. Isolate and attach warning labels to any downstream load connections, as applicable. Be sure to strictly follow the start-up procedures, otherwise user will be responsible for the severe consequences resulted from wrong operation.

1. Open the front doors of 500kVA UPS rectifier cabinet and inverter cabinet (rectifier cabinet and switch cabinet for 800 kVA UPS) to gain access to the power switches. Confirm whether the internal maintenance bypass switch Q3 is opened. Confirm whether the fuse FB1, FB2, FB3, FB4 are closed.

(Note: FB1~FB4 are located in the middle part of the inverter cabinet of 500 kVA UPS. And FB1, FB2 are in the upper part of the rectifier cabinet, while FB3, FB4 are in the upper part of the switch cabinet of 800 kVA UPS)

Note

All the operations that are related to the open/close of the maintenance bypass switch should be completed within 3 seconds to avoid fault, and this also applies to the operations of maintenance bypass switch in sections 5.4, 5.5, and 5.6.

2. Close the external circuit breakers of rectifier and bypass input.

At this time, the system is powered on and the LCD displays the startup screen. See *0Startup Screen*

3. Close the bypass switch Q2, the output switch Q4 and all the output external circuit breakers (if there is any).

At this time, you need to check if the LCD displays that the bypass input power path is in green color. Otherwise check if the switch Q2 and switch Q4 are closed. Click “STARTUP”-> “Manual Start” menu The LCD displays the dialog of “Click OK button to turn on the bypass or skip the bypass to turn on the rectifier”. Click OK button and another dialog shows up, that is, “click OK button to send ‘Turn on BPSS command’”. Click “OK” button again, the bypass starts up and the UPS operates in bypass mode. At this time the power flow displayed by LCD is as shown in Figure 5-3. If you click “Skip”, then directly enter step 4 of starting rectifier.

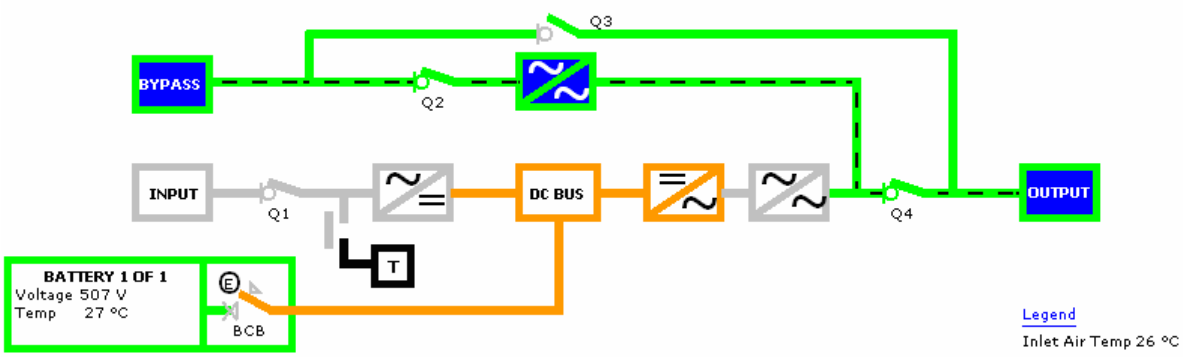


Fig.5- 3 Bypass mode displayed by LCD

4. Check out if there is any alarm shown in the left bottom window in the LCD. If there is any alarm, stop the next step operation, power off the UPS and check according to the Table 4-3 or contact the local customer service center.

5. Close the input switch Q1.

At this time, you need to check if the LCD displays that the rectifier input power frame is in green color. Otherwise check if the switch Q1 is closed.The LCD displays a dialog of “Click ‘OK’ button to send the command of turning on the rectifier”. Click “OK”, the rectifier performs soft-start and the rectifier frame is in flashing green color. After several seconds, the rectifier starts stable operation, and then the rectifier frame become normally lighting and is in green color and bus voltage reaches the rated voltage.

6. Then, the LCD displays a dialog of “Click ‘OK’ button to send the command of turning on the inverter”. Click “OK” to start the inverter and the inverter frame become normally lighting and the inverter starts normal operation. After the system detects the battery, the battery frame becomes green.

7. The LCD displays a dialog of “Click ‘OK’ button to send the command of enabling the MBD”. Verify if the bus voltage and the battery polarities are correct. Click OK if the battery charging is needed, and close the external battery circuit breaker. If no battery is connected, click “Skip” to enter the next step. The battery circuit breaker is located in the battery cabinet.

8. Then, the LCD displays a dialog of “Click ‘OK’ button to send the command of transferring”. If the bypass is in the synchronization range of inverter, click OK and the UPS transfers from bypass mode to inverter mode.

At this time the bypass static switch frame becomes dark and the output static switch frame becomes normally lighting and is in green colour. The UPS has entered the normal mode.

9. Close the cabinet door. Check if there is any alarm shown in the active event window in the LCD. Check if the power flow displayed in LCD is as shown in Figure 5-4.

If there is any alarm, handle the fault according to Table 4-3.

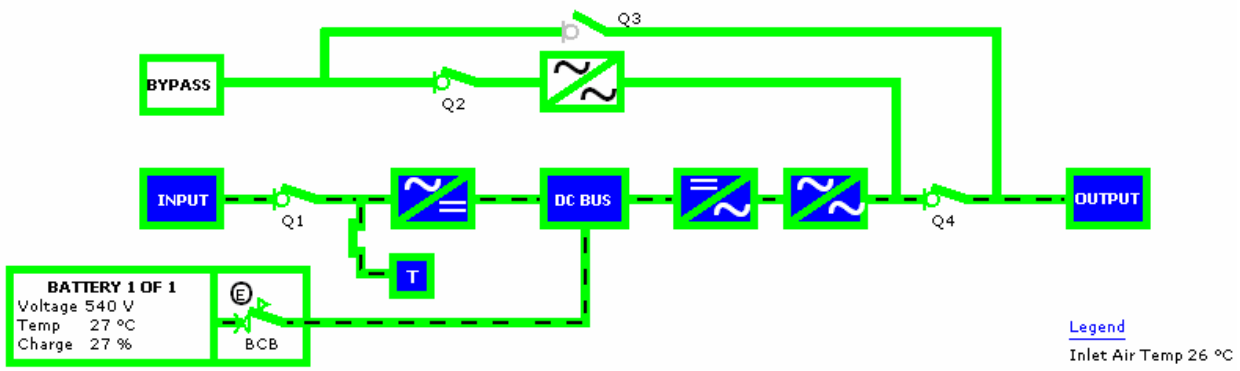


Fig.5- 4 LCD display in normal mode

UPS operates in normal mode

Battery Test Procedures

The Battery test procedures transfer the UPS into shared source mode wherein approximately 20% of the load power is supplied by the battery and the balance by the main input power.

Battery test type and preconditions

1. There are two kinds of battery tests to select from:

   Battery maintenance test: Verifies the battery integrity and partially discharges the battery (20%).

   Battery capacity test: Verifies precisely the battery capacity and fully discharges the battery (until low battery voltage alarm)

2. The tests can be carried out when the two following conditions are satisfied:

   The load must be larger than 25% of rated UPS capacity.

   The battery must have been undergone float charging for 5 hours or more.

The battery test procedures are driven through operator control and display LCD menus. The test is immediately terminated in the event of a battery or a mains power failure and the total load power is supported from the utility source or batteries without interruptions.

Test procedure

1. Manual Test

   Perform battery test

Select “battery management” from the UPS operator control and display LCD, and then select “Manual battery test” menu and click “start” button to start the battery test.

After this test is completed, the system automatically updates the battery information, including the battery autonomy time. The battery autonomy time is the battery discharging time when the UPS is in battery mode.

   Stop the test

During the battery test procedures, you can select the “Stop” in the menu of “Manual battery test” to stop the battery test.

2. Auto test

Select “Configuration->Battery management” in the UPS operator control and display LCD, and then select “Auto test”. A dialog is popped up and select “Enable” for auto test, set relevant auto test parameters and save them. When the preset start time is reached, the battery enters auto test. See *4.4.1Battery Management* for relevant procedures.

Maintenance Bypass Procedure (UPS Shut Down)

The following procedure transfers the load supply from being protected by the UPS into being connected directly to the bypass supply through a maintenance bypass switch.

Caution – risk of load power interruption

Except in emergency situations, so as not to risk a short interruption in powering the load, before initiating this operating procedure, confirm that no warning is displayed in the left bottom corner of the LCD screen. If a warning status is displayed, the operator will be prompted to confirm or cancel any action that can lead to load interruption.

1. Select “SHUTDOWN” menu in the UPS LCD and the interface as shown in Figure 4-20 is displayed.

2. Select and click the “UPS” button to pop up the dialog as shown in Figure 4-21, and click OK button.

This operation will close the UPS rectifier, inverter and battery, and the UPS powers the load via bypass. At this time, the frames of rectifier, inverter and battery become gray, while the bypass frame and power path become green.

3. Open the external door of cabinet and close the internal maintenance bypass switch Q3.

At this time, the maintenance bypass is in parallel with the UPS bypass. The LCD will display relevant operations, that is, the open/close of maintenance bypass switch.

4. Open output switch Q4 and bypass switch Q2.

At this time, the transfer from the UPS to maintenance bypass is completed and the load is powered by the maintenance bypass.

Note

The load equipment is not protected from AC supply aberration.

5. Open the outer door of rectifier cabinet. Open the rectifier input circuit breaker Q1.

6. Open the external battery circuit breaker that is located in battery cabinet.

At this time, all the frames displayed in the LCD become gray. The power path of maintenance bypass becomes constant green with power flow. The power flow displayed in LCD is as shown in Figure 5-5.

7. Confirm if the LCD displays that Q1, Q2 and Q4 are opened and Q3 is closed. Click the “Reset” button in the screen to clear the Q3 closed / Q3 opened alarm information.

8. When maintaining the UPS, if the rectifier input has external distribution circuit breaker, you need to open this circuit breaker and put the fuse FB3 to open status. Otherwise, you need to put fuse FB1, FB2 and fuses FB3.

9. Close all the cabinet doors. At this time, all the internal power supplies are closed and the LCD displays closed status.

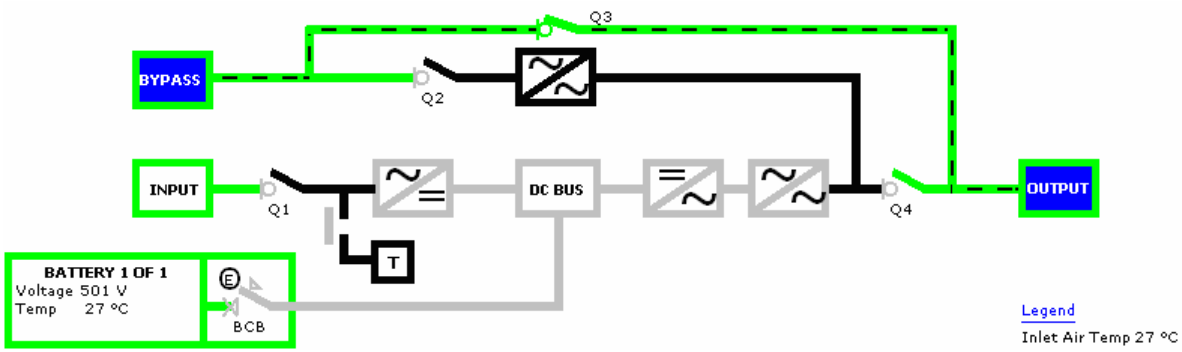


Fig.5- 5 LCD display in maintenance bypass mode

At this time, the load is powered on the maintenance bypass and the UPS totally shuts down.

WARNING

At this time, the mains voltage presents at all the rectifier and bypass input terminals and the output terminal of output switch Q4..

Transfer from Maintenance Bypass Mode to Normal Mode

The following procedure transfers the load from maintenance bypass mode to normal mode.

1. Open the outer door and inner door of rectifier cabinet. Close the fuses FB1, FB2, FB3 and FB4 .

2. After the LCD displays that the startup is completed, confirm whether the bypass input power frame is in green and close the bypass input circuit breaker Q2 and output circuit breaker Q4. Click “STARTUP”-> Enter “manual Start” menu to display the dialog of “Click OK button to turn on the bypass or skip the bypass to turn on the rectifier”. Click OK button and another dialog shows up, that is, “click OK button to send ‘Turn on BPSS command’”. Click “OK” button again and the bypass starts up. The UPS then operates in bypass mode and at this time the power flow displayed by LCD is as shown in Figure 5-3,图与实际不对应，这是 maintenance 和 bypass 是同时导通的.

WARNING

You must turn on the bypass first and then open the maintenance bypass switch, otherwise load power failure will happen.

3. Open internal maintenance bypass switch Q3.

4. Close the input switch Q1.

At this time, you need to check if the LCD displays that the rectifier input power frame is in green color. Otherwise check if the switch Q1 is closed. The LCD displays a dialog of “Click ‘OK’ button to send the command of turning on the rectifier”. Click “OK”, the rectifier performs soft-start and the rectifier frame is in flashing green color. After several seconds, the rectifier starts stable operation, and then the rectifier frame become normally lighting and is in green and DC bus voltage reaches the rated voltage.

5. Then, the LCD displays a dialog of “Click ‘OK’ button to send the command of turning on the inverter”. Click “OK” to start the inverter and the inverter frame become normally lighting and the inverter starts normal operation. After the system detects the battery, the battery frame becomes green.

6. The LCD displays a dialog of “Click ‘OK’ button to send the command of enabling the MBD”. Verify if the bus voltage and the battery polarities are correct. Click OK if the battery charging is needed, and close the external battery circuit breaker. If no battery is connected, click “Skip” to enter the next step. The battery circuit breaker is located in the battery cabinet.

7. The LCD displays a dialog of “Click ‘OK’ button to send the command of transferring”. If the bypass is in the synchronization range of inverter, click OK and the UPS transfers from bypass mode to inverter mode.

At this time the bypass frame becomes dark and the output static switch frame becomes normally lighting and is in green. The UPS has entered in normal mode.

8. Close all the cabinet doors. Check if there is any alarm shown in the active event window in the LCD. Check if the power flow displayed in LCD is as shown in Figure 5-4.

If there is any alarm information, handle the fault according to Table 4-3.

At this time, UPS has re-transferred to normal mode

Shutdown Procedure (Complete UPS And Load Shutdown)

This procedure must be followed to completely power off the UPS and load. All power switches, isolators and circuit breakers will be opened and UPS does not power the load.

Caution

The following procedure will cut all power supply to the load equipment.

1. Select “SHUTDOWN” menu in the UPS LCD and the shutdown interface as shown in Figure 4-20. Select and click the “System” button to pop up the dialog as shown in Figure 4-22, that is, “click OK button to shut down the UPS and the power to the load will be switched off”. Click OK button

This operation will turn off the rectifier, inverter and bypass static switch and disconnect battery, and the load is powered off.

2. Open the front doors, open the power switches Q1, external battery circuit breaker(BCB), bypass switch Q2, and output switch Q4 one by one.

3. Ensure that the maintenance bypass switch Q3 is open. Confirm that all the switches displayed on the power flow diagram in the LCD are opened.

4. To completely isolate the UPS from the AC supplies, if the rectifier and bypass inputs have external switches, you need to turn off these switches respectively. Otherwise, you need to put the FB1, FB2 and FB3 to open status and attach the WARNING labels.

5. Turn off the external output switches.

With all the internal power sources driven by external power supplies turned off, all the frames in the LCD become dark.

EPO Procedure

The UPS provides an EPO button on the front door of the rectifier cabinet. The EPO button is designed to switch off the UPS in emergency conditions (that is, fire, flood, etc.). To achieve this, just press the EPO button, and the system will turn off the rectifier, inverter and stop powering the load immediately (including the inverter and bypass), and the battery stops charging or discharging.

If the input utility is present, the UPS control circuit will remain active; however, the output will be turned off. To remove all power from the UPS, refer to step 2 to step 5 in 5.6 *Shutdown Procedure (Complete UPS And Load Shutdown)*.

UPS Reset Procedure after EPO Procedure

After using EPO to shut down the UPS and clearing all the faults according to the prompt information displayed in screen, carry out this procedure to restore the UPS to normal operation.

After confirming that the fault is cleared and there is no remote EPO signal:

1. The control display LCD panel pops up a dialog “Click OK button to reset EPO latch signal”. Click the OK button to make the system exit the EPO status.

2. Click “STARTUP->Mannual Start” menu in the LCD screen.

3. Follow the procedure described in 5.2 *Start-Up Procedure (Into Normal Mode.)*

 WARNING
If the maintenance bypass switch Q3 is closed and the bypass input is available, the UPS has output.

Auto Restart

When the mains power is failure, the UPS draws power from the battery system to supply the load until the battery voltage reaches the end of discharge voltage (EOD), and the UPS will shut down.

The UPS will automatically restart and enable output power if following requirements are satisfied:

After the mains power is restored

If the Auto restart is enabled, and if the Auto Restart Type has been set up (default is charging only). There are three kinds of Auto Recovery: bypass mode only, charging only and full system enabled.

After the Auto Restart Delay

After the Auto Restart, if the Auto Restart is set to charging only or full system enabled, the UPS charges the battery to avoid the power failure risk to the load due to the next time of mains power failure.

 Note

In Auto Restart process, manual start is disabled. Auto Restart function must be set through host computer.

Language Selection

The LCD menus and data display are available in two languages: Chinese and English.

Proceed the following procedure to select a language needed:

1. Enter the “CONFIG/User Settings/System Parameters” menu and a dialog as shown in Figure 5-6 is popped up.

Fig.5- 6 Dialog of selecting language and modifying the current date/time

2. Click the button “Language”, then two available languages are displayed , Chinese and English.
3. Select the display language and click “OK” to return to the dialog as shown in Figure 5-6.
4. After the above setting is made, click “Save” and a dialog for password verification is popped up.
5. Enter the password and click “OK” to confirm the entry of password.

Changing The Current Date And Time

To change the system date and time:

1. Enter the “CONFIG/User Settings/System Parameters” menu and a dialog as shown in Figure 5-6 is popped up.
2. Click the button “Date”. The dialog of “Month/Day/Year” is popped up.
3. After changing the “Month/Day/Year”, click OK to return to the dialog as shown in Figure 5-6.
4. Click the button before the “Time”. The dialog of “Hour/Minute/Second” is popped up.
5. After changing the “Hour/Minute/Second”, click OK to return to the dialog as shown in Figure 5-6.
6. Click “Save” and a dialog for password verification is popped up.
7. Enter the password and click “OK” to confirm the entry of password.

Change Password

The system is password protected to limit the operating. The default password is “NXL”, which is case-sensitive. You can only operate and test the UPS and battery after entering correct password.

To change the password:

1. Enter the “CONFIG/User Settings/System Parameters” , and a dialog as shown in Figure 5-6 is popped up.

2. Click the button “Password”. The dialog of “Change Password” is popped up.

3. Enter the current password, and then enter new password and enter the new password again. Click OK to return to the dialog as shown in Figure 5-6.

4. Click “Save” to complete the setting.

6. Battery

This chapter introduces the battery, including the battery safety, installation and maintenance information, and the battery protection function, as well as the connections of the optional BCB box (cabinet) and battery temperature sensor.

Introduction

The UPS battery consists of battery blocks connected in series to provide a nominal DC input voltage for the UPS inverter. The required autonomy time (the time that the battery can maintain supply to the load in the event of a mains failure) is limited by the ampere-hour size of the individual battery blocks and in some cases this could mean several strings need to be connected in parallel.

In order to facilitate the HIPULSE-NXL 500/800kVA UPS installation, generally the batteries are installed in specially designed BCB cabinet or battery rack.

Be sure to disconnect the battery from the UPS module when undertaking maintenance or service procedures. This is facilitated by means of a suitably rated battery circuit breaker, which must be located as close as possible to the battery terminals, and the power and control cables connected to the UPS using the most direct route possible.

If multiple sets of batteries connected in parallel are used to increase battery autonomy time, the extension must be fitted with a sectioning device to permit work to be performed on one set of batteries while the others remain in service.

For external battery assembly, Emerson offers an optional battery cabinet (the features of which depend on the size of the UPS). Normally, you must select a corresponding battery circuit breaker for each UPS, in order to disconnect the battery from the UPS when the UPS requires maintenance or repair. The BCB cabinet includes a battery interface board. For 500kVA UPS, this BCB cabinet is designed to be wall-mounted; For 800kVA UPS, this BCB cabinet is designed to be floor mounted and is connected between the UPS and the battery. Refer to *6.9 Battery Cabinet (Optional Parts)* for more information.

Safety

Special care should be taken when working with the batteries associated with the HIPULSE-NXL 500/800kVA UPS. When all the cells are connected together, the battery terminal voltage will exceed 540V and is potentially lethal. Please observe the safety codes for high voltage operation. Only qualified person can install and maintain the batteries. A primary safety consideration is to install the cells in a key-lockable cabinet or a purpose-designed, dedicated battery room so as to isolate the batteries from other personnel except the qualified maintenance engineers.

WARNING

1. The battery must be reliably connected. After connecting the batteries, be sure to calibrate the connections between all the wiring terminals and batteries. The torque requirements specified in battery user manuals provided by battery manufacturer must be met. The connections between all the wiring terminals and batteries must be checked once a year. Otherwise fire accident will occur!

Correct connection	Wrong connection	
Tighten the terminal bolt of the battery with specified torque.	Both bigger and smaller torques will cause poor connection of terminal. Under certain condition, electric arc or heat concentration may occur in the terminals, which finally results in fire accident.	
		

2. Before accepting and using the goods, be sure to check the battery appearance. If the package is broken or battery terminal is dirty, eroded, and rusted or the case has cracks, distortion and leakage, be sure to replace the battery. Otherwise, the battery capacity will be lowered, and current leakage and fire accident will happen.

Battery damaged in transportation	Condition of battery that has been discharged for one week
	

3. Since the battery is heavy, please use correct methods to carry or lift the batteries to avoid human injury or battery terminal damage. In severe condition, the battery may caught fire.
4. The battery connection terminal should not be applied with any external force such as the pulling or twisting force from the cable. Otherwise the internal connection of the battery may be damaged, or even fire accident may be caused.
5. The batteries should be installed in a clean, cool and dry environment. Do not install the batteries in a sealed battery chamber or sealed room. The battery ventilation should meet the requirement of EN50272-2001, otherwise the battery may swell, catch fire or result in human injury.
6. The battery installation location should be far away from the heating sources such as transformer. Do not use and keep the batteries in the place close to the fire source. Do not burn the battery or heat the battery in fire, otherwise the battery will leak, swell, catch fire or explode.
7. Do not connect any conductor between the positive and negative terminals of the battery. When operating the battery, be sure to remove the metallic objects such as ring, watch, necklace and other metallic decorating objects. Make sure the operating tools such as wrench are wrapped with insulation tapes otherwise the battery may catch fire, cause human injure or result in explode.
8. Please do not dissemble, modify and damage the battery. Otherwise the battery may have short circuit, leakage or result in human injure.
9. Use a wet cloth that has been twisted to clean the battery case. Do not use a dry cloth or other dry tool to clean the battery case so as to avoid ESD or spark. Do not use organic solution such as gasoline or evaporating oil to clean the battery case otherwise the battery case may be broken, and the worst consequence may be the fire accident.
10. The battery contains sulfuric acid. In normal operation, all the sulfuric acid is attached to the separation board and plate in the battery. However, when the battery case is broken, the acid will leak from the battery. Therefore, be sure to wear a pair of protective glasses, rubber gloves and skirt when operating the battery. Otherwise, you may become blind if acid enters your eyes and your skin may be damaged by the acid.
11. At the end of battery life, the battery may have internal short circuit, dry of electrolytic and erosion of positive/negative plates. If this condition continues, the battery may have temperature out of control, swell or leak. Be sure to replace the battery before these phenomena happen.

UPS Batteries

It is a common practice in UPS installations to use valve-regulated cells. The term '*valve regulated*' is used currently in place of either '*sealed*' or '*maintenance free*' both of which have been used in the past.

Valve-regulated cells are not 'sealed,' and will release gas, particularly on overcharge. The amount of gas given off is less than for a flooded cell. However, considering the temperature rise in the design of the battery installation, be sure to reserve adequate clearance for good ventilation of the cells.

Similarly, valve-regulated cells cannot be regarded as maintenance-free, as they must be kept clean and their connections checked periodically for tightness and free of corrosion. Refer to battery maintenance section for details.

The number of battery strings connected in parallel should not exceed four. Do not mix the batteries of different types, name and ages, otherwise, some batteries may be over discharged and some batteries may be under discharged due to the inconsistent battery parameters, which results in the earlier failure of some batteries and in adequate battery capacity.

Batteries are fully charged in storage; However, some capacity of the batteries may be lost due to self-discharging in storage and transportation processes. Therefore, be sure to re-charge the batteries before using them. When storing the batteries, the ambient temperature should be within -15°C to +45°C, and the best temperature range is 20°C to 25°C. In order to compensate the self-discharging of the batteries during battery storage process, re-charge the battery every 3 months. The time for different battery is also different, so please re-charge the battery according to the manufacturer's instructions.

It is especially important that the battery is fully charged before attempting a field test of the autonomy time. This may require several days to complete; therefore any field test concerning the batteries should take place only after the battery has been on uninterrupted float charge for at least one week.

Cell performance typically improves after a few weeks in service or after two or three discharge and recharge cycles.

In order to avoid over charging or under charging to the battery, please set the battery management parameters according to the float charging voltage and temperature compensation coefficient specified in the user manual provided by the battery manufacturer. Charge the battery immediately after it has discharged.

Installation Design Considerations

Note

Full safety instructions concerning the use and maintenance of UPS batteries are provided in the appropriate battery manufacturers' manuals. The battery safety information contained in this section relates to key considerations which must be taken into account during the installation design process and might affect the design outcome depending on local conditions.

Battery Installation Environment and Number of Batteries Needed

Installation Environment

Fresh air flow volume (EN50272-2001)

The battery application environment must be well ventilated. During the battery operating process, the requirement for fresh air ventilation is as follows:

Q = 0.05 × n × Igas ×Crt × 10–3 [m3/h]

Where:

Q— Fresh air flow per hour and the unit is m3/h

n— Number of battery cells

Igas— Gassing current density in battery float charging or equalize charging status, unit: mA/Ah

Igas=1 at 2.27V/cell float charging condition

Igas=8 at 2.35V/ cell float charging condition

Crt—20hr battery rated capacity

Temperature

Table 6- 1 Using temperature range

Category	Temperature value	Remark
Recommended optimum temperature	20ºC~25 ºC	The battery operating temperature can be neither high nor low. If the average battery operating temperature rises from 25 ºC to 35 ºC, so the battery life will be reduced by 50%; If the battery operating temperature is higher than 40 ºC, the battery service life will decrease each day in the exponent level.
Short time acceptable temperature	-15 ºC~45 ºC	

The higher the temperature, the shorter the battery service life. The lower the temperature, the lower the battery charging and discharging capabilities.

The battery must be installed in cool and dry environment that is free of heating source and sunshine with ambient humidity less than 90%.

Ambient temperature, ventilation, spacing, float charge voltage and ripple current all affect the battery temperature. Uneven temperature distribution through the battery string will cause the voltage distribution to be uneven which can also lead to problems — it is therefore important to maintain an even temperature across the whole battery string. The temperature difference between different layers of batteries should be less than 3°C. Valve-regulated cells are very sensitive to temperature and should be operated at a temperature between 15°C and 25°C. When batteries are cabinet-mounted adjacent to the UPS module, it is the battery which dictates the designed maximum ambient temperature, not the UPS. That is, in the case of valve-regulated cells, the ambient room temperature should be kept between 15°C and 25°C, but not the main equipment operating temperature range. Temperature deviations are acceptable for short periods of time provided the average temperature does not exceed 25°C.

Number of Batteries Needed

The nominal DC bus voltage, and therefore battery float voltage, is set according the module's rated input and output voltages, and usually set to 540Vdc, and the expected float charging voltage for a cell is 2.25V. The number of battery cells, end of discharge voltage, and float charging voltage under 380V/400V/415V are the same. See Table 6-2 for details.

Table 6- 2 Number of Batteries Needed

Parameter	*380V/400V/415V*
Number of cells used (standard)	228 to 246, 240 is recommended
End-of-discharge voltage	1.60 to 1.88 Vdc/Cell, 1.62 is recommended, that is 389V
Float charging voltage	2.15 to 2.3 Vdc/Cell, 2.25 is recommended, that is 540V

Battery Protection

Attention

It is recommended to use the battery circuit breaker provided by Emerson to avoid risk.

The battery is connected to the UPS through a BCB which is manually closed and electronically tripped through the UPS control circuitry. If the cells are rack-mounted (or located remote from the main UPS cabinet), the BCB must be mounted as close as possible to the batteries themselves, and the power and control cables connected to the UPS using the most direct route possible.

Features of the BCB include:

Isolation from battery to achieve safety and reliability

Short circuit protection

Automatic opening in the event of inverter lockup due to battery under voltage to prevent battery damage caused by over discharge

Tripping by remote emergency power off (EPO) button if installed

Operation error protection

To achieve the required autonomy time, it may be necessary to parallel battery strings. In which case, the battery circuit breaker should be placed downstream of all parallel battery strings.

Attention

All equipment servicing procedures should be carried out only by trained personnel.

Battery Connection

Fitting The Batteries

1. Prior to installation, be sure to check if the appearance of the batteries has been damaged and if the spare parts are complete. In addition, read the user manual or installation instructions provided by battery manufacturer carefully.

2. A minimum space of 10 mm must be reserved on all vertical sides of the battery block to permit free air movement around the cells.

3. A certain clearance should be reserved between the top of the cells and the underside of the shelf above, as this is necessary for monitoring and servicing the cells.

4. When installing the batteries always work from the bottom shelf upwards to prevent raising the center of gravity. Install the batteries reliably and avoid vibration and mechanical bumping.

Connecting The Battery

1. All cabinets or racks must be connected together and must be well earthed.

2. When using multi battery strings, connect the cells / blocks in series first and then in parallel. Do not connect power until the total voltage of the battery string is verified correct through measurement. Be sure to connect the positive/negative terminals of the batteries to those of the UPS respectively with reference to the markings of positive/negative terminals. Reverse connection of battery polarities will result in explosion, fire accident, the damage of batteries and UPS, and human injure.

3. Each battery terminal should be insulated after its connection has been made.

4. When connecting the cables between the battery terminals and the circuit breaker always connect the circuit breaker terminal first.

5. The bending radius of cable should be more than 10D, where "D" is the outer diameter of cable.

6. After connecting the cables of battery, it is absolutely prohibited to pull the battery cable or cable terminal.

7. When connecting the cable, do not cross the battery cables and do not bind the battery cables together.

Battery Installation

Whatever the type of mounting system selected, the following conditions should be noted (Refer to Figure 6-1):

❶ Layout of cells:

Whatever battery mounting system is used, the batteries should be laid out in such a manner as to make simultaneous contact with two exposed live parts having a potential greater than 150V impossible. Where this is *not* possible, insulated terminal shields must be installed and insulated cables must be used for connections.

❷ Service platform

The service platform (or duckboard) must be slip-proof, insulated from the floor and be at least one meter wide.

❸ Connections:

All connections must be as short as possible.

❹ Battery circuit breaker:

The Battery Circuit Breaker is generally installed in the wall-mounted box close to the battery. The connection of BCB cabinet available for the 'HIPULSE-NXL UPS' is described in the following paragraph.

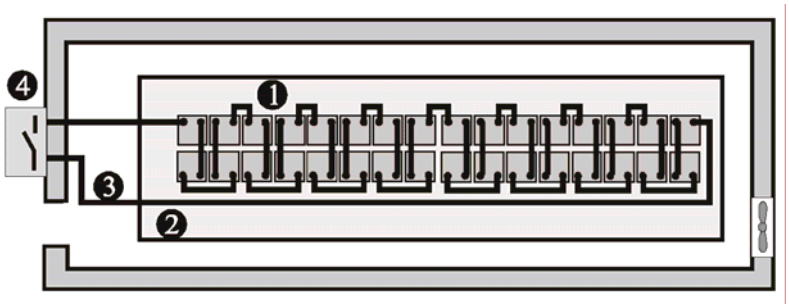


Fig.6- 1 Battery room design

Battery Cabinet (Optional)

The BCB box of NXL500kVA UPS is wall-mounted, and the installation holes and dimensions are shown in Figure 6-2. The BCB cabinet of NXL800kVA UPS is floor-mounted. The installation holes and dimensions are shown in Figure 6-3 and Figure 6-4.

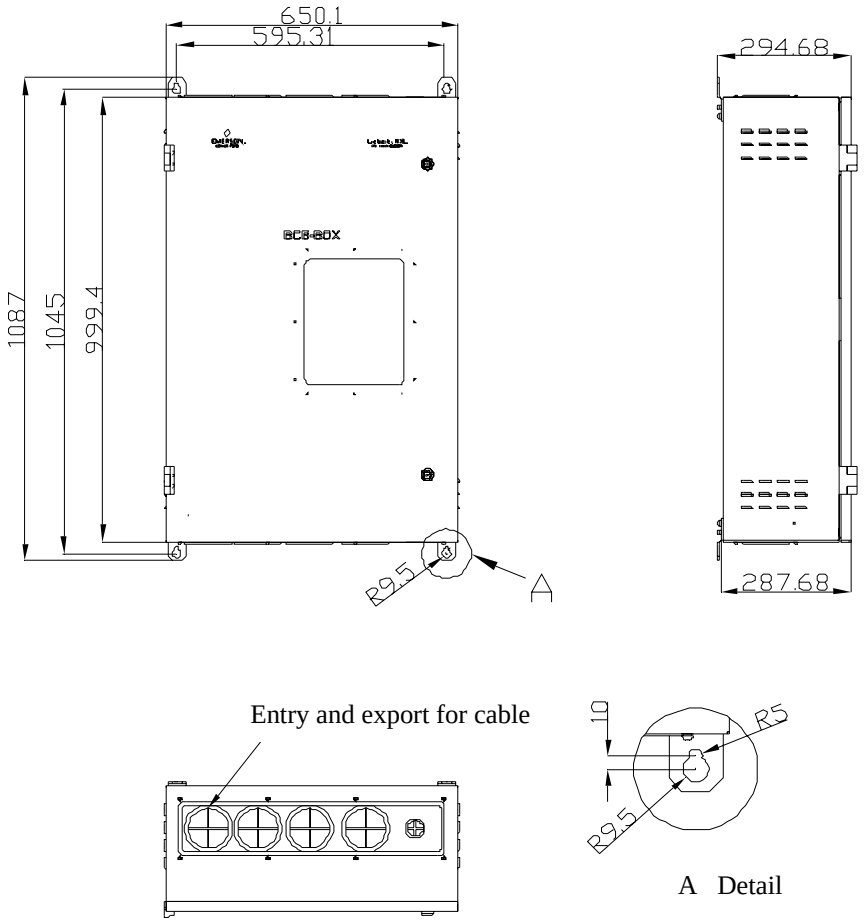


Fig.6- 2 Installation hole dimensions for battery cabinet of 500kVA UPS (Unit: mm)

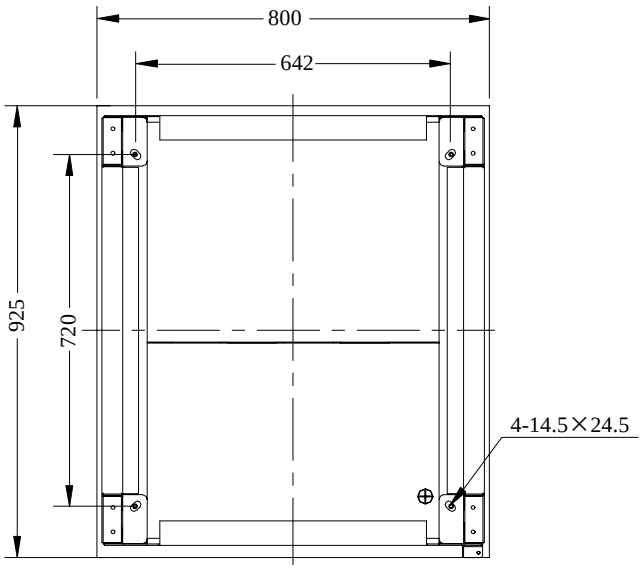


Fig.6- 3 Installation hole dimensions for floor-mounted of battery cabinet (Unit: mm)

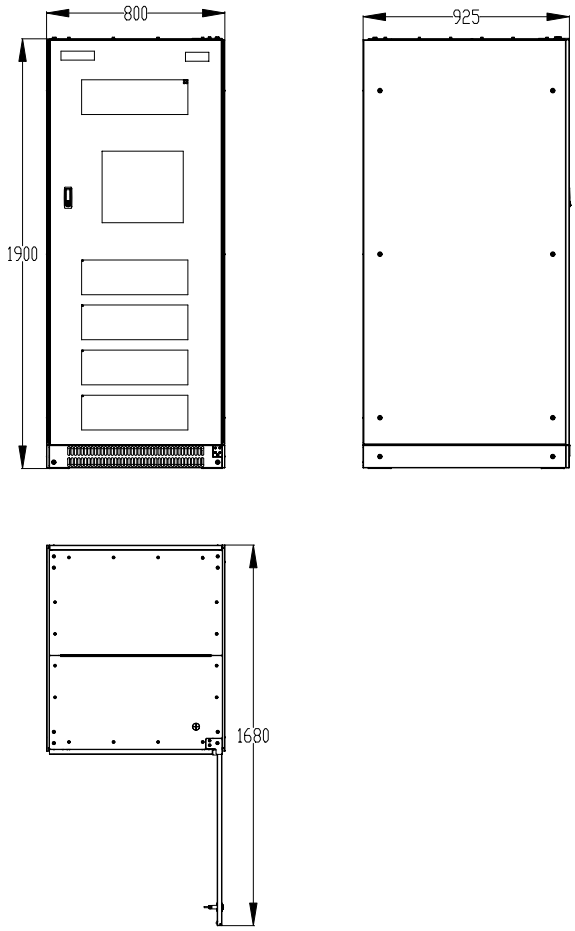


Fig.6- 4 Dimensions of BCB cabinet

The battery cabinet contains a BCB and a BIB (battery interface board, Model: 02-806811).

The battery cabinet is fitted as close as possible to the battery. The battery CAN cable is connected to the EIB (external interface board) of UPS rectifier cabinet via the TB1154 interface on the BIB, as shown in Figure 6-5. The battery temperature sensor is connected to the P1153 interface on the BIB.

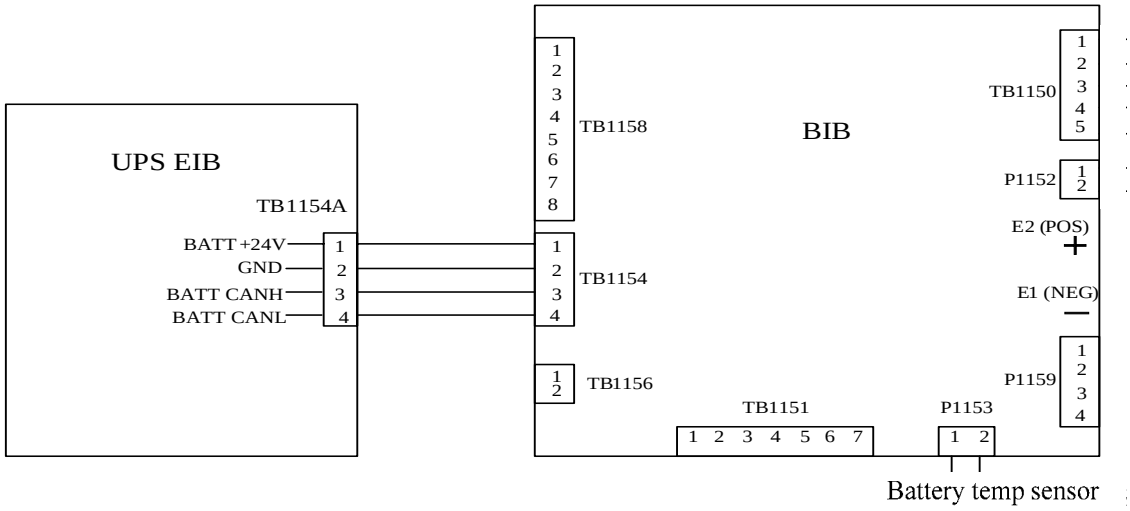


Fig.6- 5 Battery cabinet connection

Note: The control cables from the UPS to the BIB must be made using the accessory cable of the BCB cabinet, which is a shielded cable located in a separate conduit to that containing the battery power cables. The cable shield must be earthed to prevent induced EMI affecting the control operation, and both the UPS and BCB cabinet must be earthed separately.

Battery Temperature Detecting Resistor

A battery temperature detecting resistor (NTC) is provided to detect the battery temperature. This resistor is closely attached to the surface of the battery that is close to the battery circuit breaker. Another end of the detecting resistor is plugged into the P1153 interface of BIB, and then connected to the UPS logic circuits through BIB. See Figure 6-5 for detailed connections.

With this feature fitted, the nominal float voltage supplied to the battery is adjusted so as to be inversely proportional to the ambient battery cabinet/room temperature. This prevents the battery being over charged at high ambient temperatures.

Note

If there are multi battery strings, each string should be mounted with a temperature detecting resistor.

Battery Maintenance

Refer to IEEE-Std-1188-2005 and the user manual provided by the battery manufacturer for the battery maintenance and maintenance cautions.

Note

Please check the battery connection screw periodically. Check whether the screws are tightened or become loose. If there is any loose screw, be sure to tighten it.

Test and ensure all the applied safety devices are installed and operate normally. Pay particular attention to if the battery management parameter settings are correct.

Measure and record the air temperature inside battery room.

Check if the battery terminals have been damaged or have any heating phenomena. Check if the battery case or cover has been damaged.

Recycle of Batteries

If battery leakage or damage happens, please place the battery in the container that is resistive to acid and dispose the battery according to local codes.

The waste lead-acid battery is a kind of hazardous waste and is one of the major contaminants controlled by government. Therefore, its storage, transportation, using and disposal must comply with the national or local regulations and laws about the disposal of hazardous waste and waste batteries or other standards.

According to the national laws, the waste lead-acid battery should be recycled and reused, and it is prohibited to dispose the batteries in other ways except recycling. Throwing away the waste lead-acid batteries at will or other improper disposal methods will cause severe environment pollution, and the person who does this will bear the corresponding legal responsibilities.

As a lead-acid battery supplier, Emerson Network Power Co., Ltd. has set up a perfect service network and a recycling system for waste batteries so as to help the customers to dispose the waste batteries properly. Please obtain the recycling system of Emerson Network Power Co., Ltd. from the local Emerson office or nearest Emerson office. If the customer does not accept this requirement or does not use the waste batteries recycling system set up by Emerson Network Power Co., Ltd., Emerson Network Power Co., Ltd. will not bear any responsibility due to improper dispose of the waste batteries.

7. 1+N Parallel System Installation

Configuration

The HIPULSE-NXL UPS mainly has two kinds of configurations:

- Single module (expandable)
- N+1 configuration

Single module is applicable for:

- Single module system (composed of single UPS module)
- 1+1 redundant system
- 1+N parallel system (with static switch that has a distributed bypass)

N+1 configuration is used for:

- N+1 system (with a integrated bypass static switch)

This manual will introduce the single module and parallel system. Another manual will be dedicated for N+1 parallel system.

1+N system is composed of two or more than two (up to 8) UPS modules with same capacity, and each module shares the UPS load.1+N system has following two types:

- Parallel for capacity expansion: The system is composed of minimum number of UPS modules that can meet the system load requirements.
- Redundant parallel: The system is composed of the number of UPS modules that is larger than the load capacity.

The basic installation procedures of 1+N parallel system are the same with those of the UPS single module system. In this section, only the installation procedures related to the parallel system are introduced.

Note
The parallel system that is composed of two or more than two UPS modules needs external maintenance bypass if the load capacity is larger than that of single UPS module. When using 1+N system, use certain measures to avoid using the UPS internal maintenance bypass switch (Q3), and you can achieve this by removing the handle of the switch and placing a warning label for maintenance persons.

Overview

A parallel system that is composed of single UPS modules is equivalent to a large capacity UPS with higher reliability. To ensure that all the UPS modules are used equally and meet the relevant wiring rules, be sure to observe the following requirements:

1) The rated power, voltage and frequency of all the UPS modules should be the same.

2) The output of all the UPS modules must be connected to the same output bus.

3) For the redundant parallel system composed of more than 3 modules (or the capacity-expanded system composed of two or more than two modules), the bypass load sharing inductor should be installed. Refer to *Optional Parts*

1+N parallel system needs the parallel control signal to control the load sharing, synchronization and bypass transfer of the UPS modules. The “Parallel Control Cable” in Figure 7-1“Principal Diagram of 1+N System with Separate

Batteries" provides this function. The parallel control cable is the multi-conductor ribbon cable that connects between the UPS modules.

External Protective Devices

1) Refer to the instructions supplied in the first part of this manual — Big leakage current alarm

2) If the rectifier and bypass do not share the same power source and each UPS module has its own batteries, and if a differential switch is needed at the UPS input, the differential switch is only needed at the system bypass input.

3) In the system where all the UPS modules share the same battery, if the rectifier and bypass share the same power source and if the UPS input uses differential switch, every power input source should be installed with a differential switch. If the rectifier and bypass do not share the same power source, all bypass input source needs to be installed with a differential switch.

Install Cabinet

All the UPS modules should be installed side by side, and the cables should be connected according to *Chapter 3 Electrical Installation*.

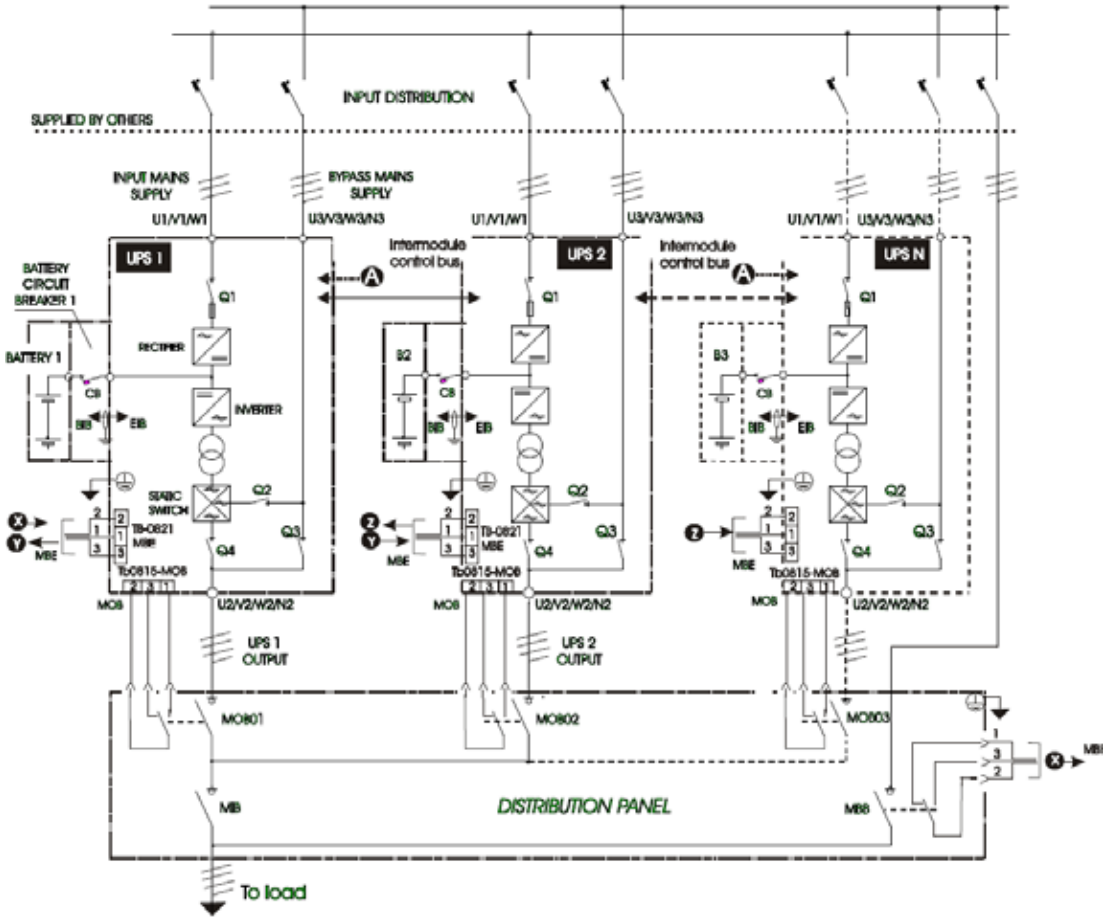


Fig.7- 1 Principal Diagram of 1+N System with Separate Batteries

To make it easier for the maintenance and system test, the optional parts of external maintenance bypass cabinet are recommended to be used in the installation.

Power Cables

The connection of the power cables of each UPS module is described in *3.1 Power Cable Connection*.

In the parallel system, the tolerance of the length of power cables connected between the UPS modules should be within ±20%.

Parallel Communication Board (IMC)

The IMC board can realize the communication between the UPS modules in 1+N parallel system. Each UPS module has an IMC board that realizes the communication with the 1+N parallel system and other UPS modules. The IMC board offers three communication buses between the UPS modules: CAN bus, power sharing CAN bus and separated I/O bus.

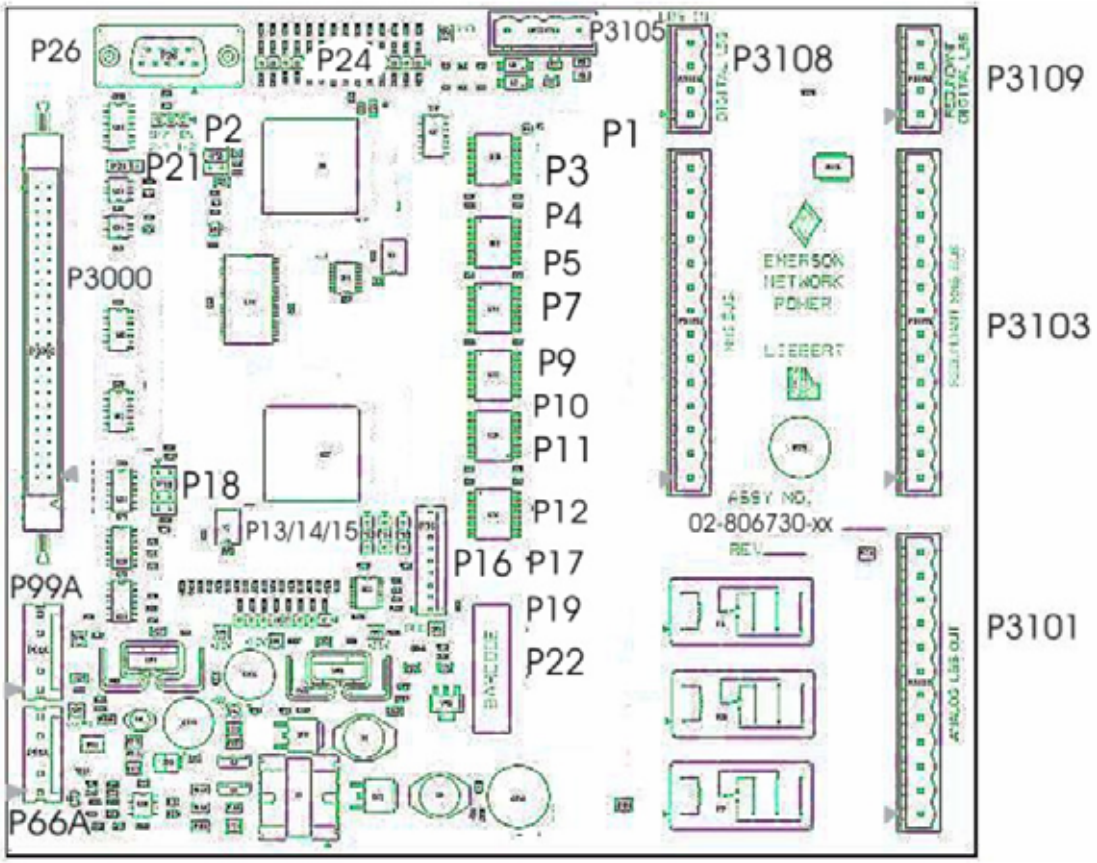


Fig.7- 2 Parallel Communication Board (IMC)

You can use a RS232 cable to connect to the PC and UPS serial communication port to configure the IMC.

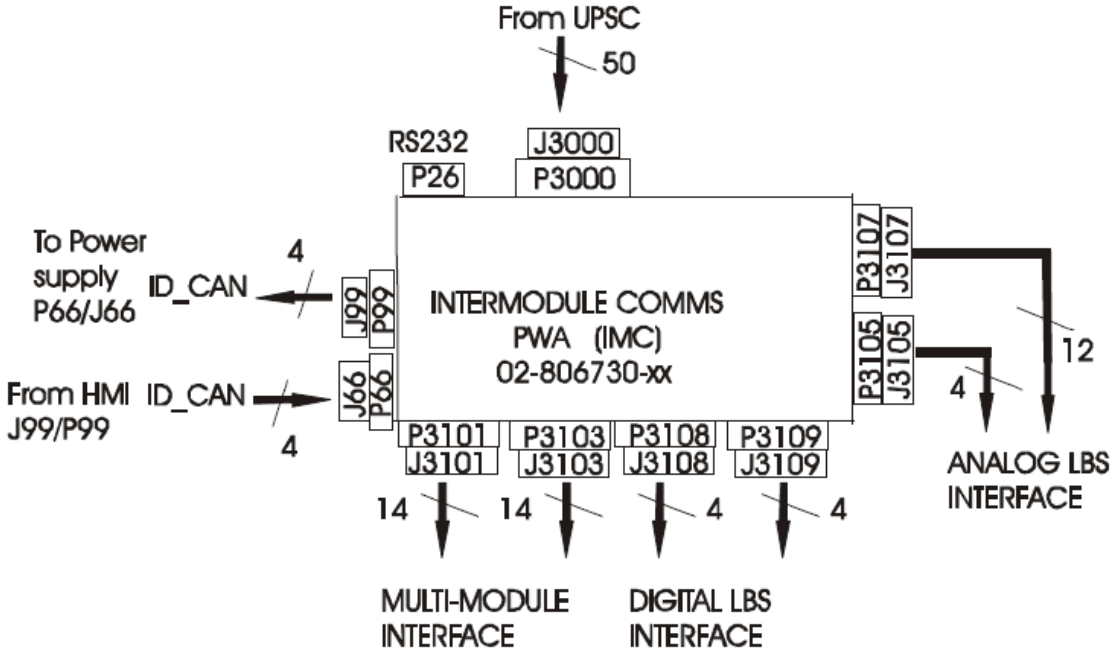


Fig.7- 3 Illustration of Parallel Communication Board (IMC)

Control Cable

As shown in Figure 7-4“Connections of Parallel Signal”, the connection between the single UPS modules is chain-type redundant connection. This kind of connection method ensures the high reliable control, that is, even if one cable among N PCS of cables is broken, the system control signal transmission, synchronization among UPS modules, load sharing, battery charging current sharing (shared battery configuration), load transfer and other common control and alarms will not be affected.

The IMC board is located in I/O area.

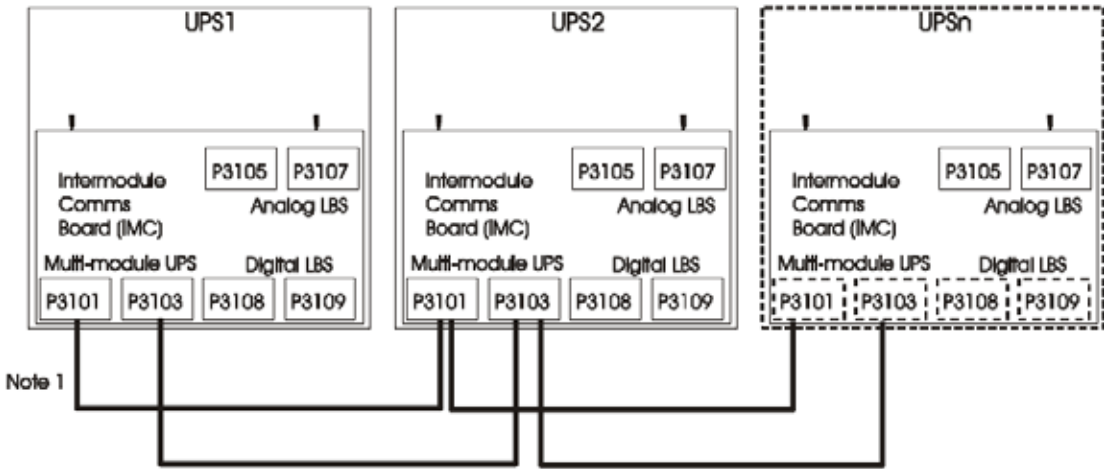


Fig.7- 4 Parallel Signal Connection

Note 1: The I/O of P1301 and P1303 is connected via “T type” connector I/O.

- Basic connection: Use the parallel cable that is a 7-conductor twisted cable (14-wires) to connect the UPS#1 (P3101) to UPS#2 (P3101), and then connect UPS#2 (P3101) to the next UPS module.
- Redundant connection: Use the parallel cable that is a 7-conductor twisted cable (14-wires) to connect the UPS#1 (P3101) to UPS#2 (P3103), and then connect UPS#2 (P3103) to the next UPS module.
- The circuit in the last IMC board in the chain connection must have a CAN termination resistor.
- Set the CAN termination jumper: P9, P22, P7, P19, P5, P17, P4, P12, P3, P11, P1, and P10

Pin 1-2= there is resistance in the circuit; Pin 2-3=there is no resistance in the circuit. When there are more than 2 UPS modules in the parallel system, set the jumper to pin 1-2 only the in the modules at two ends of the parallel system.

Note: For every single UPS module in the parallel system, be sure to change the setting from “SMS” to “1+N” from the operator control panel.

The maximum length of the parallel communication cable is 280m.Therefore, the maximum length of the cable between UPS modules in the parallel system with 8 UPS modules (the distance between every two neighboring UPS modules is the same) is 40m.

The system provides these optional parts of cables.

Remote EPO

Besides the EOP button on the front panel of the UPS, which can be used to shut down the local UPS, the UPS also supports remote EPO that can shut down several UPS modules.

Note:

- The remote EPO switch must be normally open or normally close reactive switch
- The open circuit voltage is 12Vdc, and the current is less than 10mA.
- The external EPO provides second sets of contacts, which can turn off the user input mains circuit breaker or the bypass input circuit breaker, if they are fitted with remote tripping mechanism.
- Normally closed LEPO-J0806-1-2 terminals: Has been connected in factory and located on the external interface board (EIB).

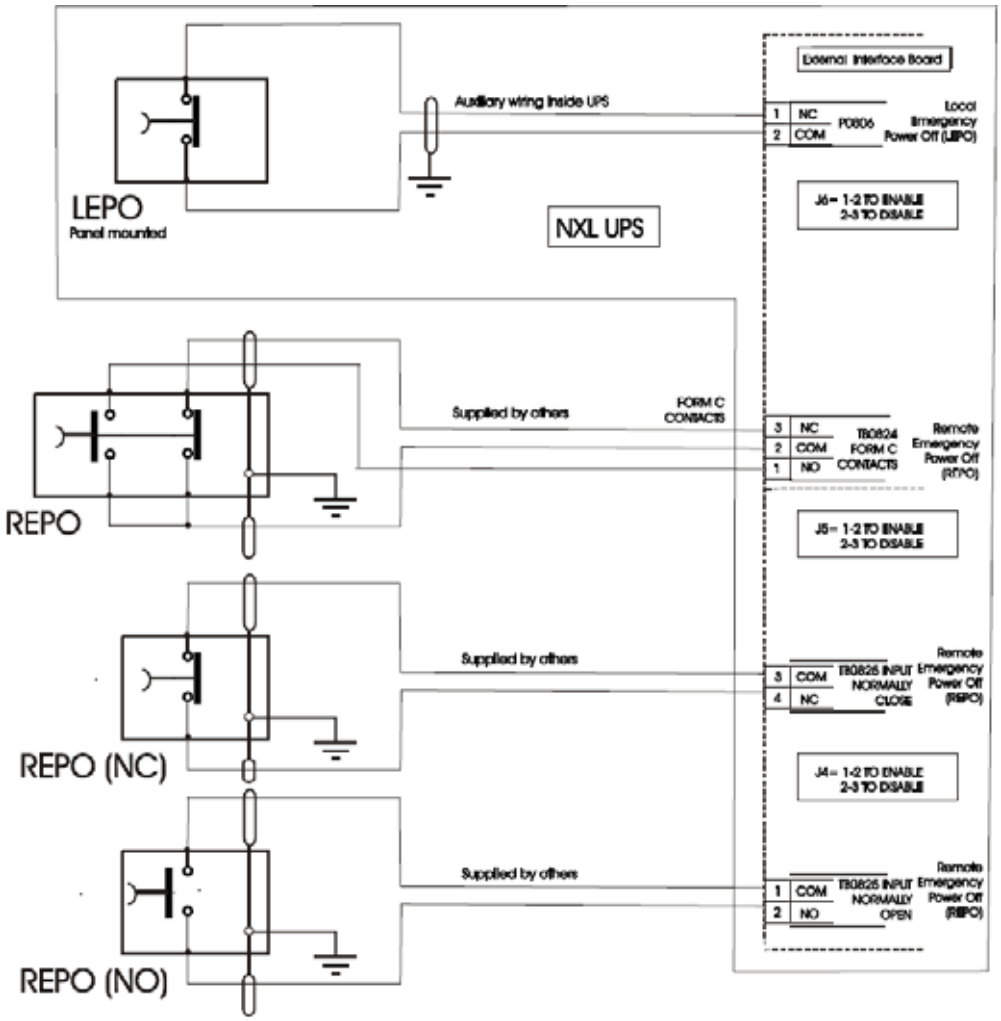


Fig.7- 5 EPO Connection

Hot Standby System

The hot standby system is composed of two UPS modules with the same capacity and connected in series, One of the UPS module is set as the host (low level) and another UPS is set as the slave (high level). The master and slave units are connected via power cables and are set via software. Normally, both the slave and master operate in normal mode. The output of the high level unit (slave) is the bypass input source of the low level unit (master).The output of the low level UPS (master) connects to the load and synchronizes with the output of the high level (slave) UPS. If the inverter that connects to the load fails, the inverter of the high level UPS (slave) powers the load via the bypass of the low level UPS (master).You can set the system in this mode: The low level UPS (master) operates alternatively in normal mode and bypass , so that two UPS are utilized equally.

Note: In hot standby system, the master unit must be started first.

External Protection Devices

Refer to *Chapter 3 Electrical Installation*

Install Cabinet

Place the UPS modules side by side and connect the cables according to the following drawing:

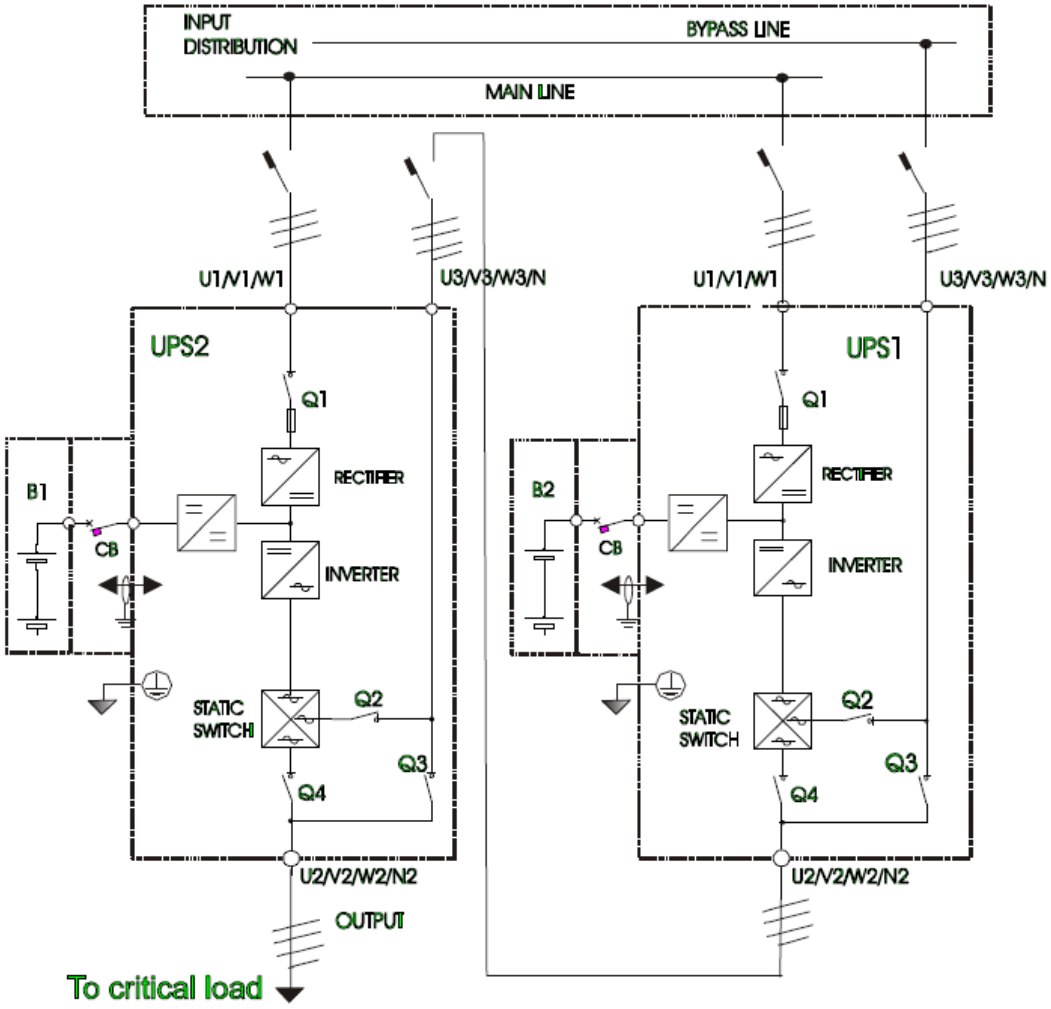


Fig.7- 6 Hot standby system

Power Cables

Besides that the high level UPS output powers the bypass of the low level UPS, and the inverter or bypass of the low level UPS powers the load, the power cable connection of the hot standby system is similar to that of the system with single UPS module.

Refer to *Chapter 3 Electrical Installation*

Control Cables

Except the single UPS module control cables, no other control cable is needed.

Dual-bus System

The dual bus system (DBS) is consisted of two independent UPS systems and each UPS system is consisted of one or more than one UPS module. The dual bus system is configured for high availability and is suitable for powering the load with multi inputs. If the load is single-input load, the static transfer switch is needed and the LBS system of the UPS should be enabled. The LBS makes the outputs of two independent UPS modules (or parallel system) keep synchronized. One system is set as the master unit and another system is set as slave unit. The LBS can enable the load to have two independent UPS sources.

External Protection Devices

Refer to *Chapter 3 Electrical Installation*

Install Cabinet

Place the UPS modules side by side and connect the cables according to Figure 7-7 Dual Bus System.

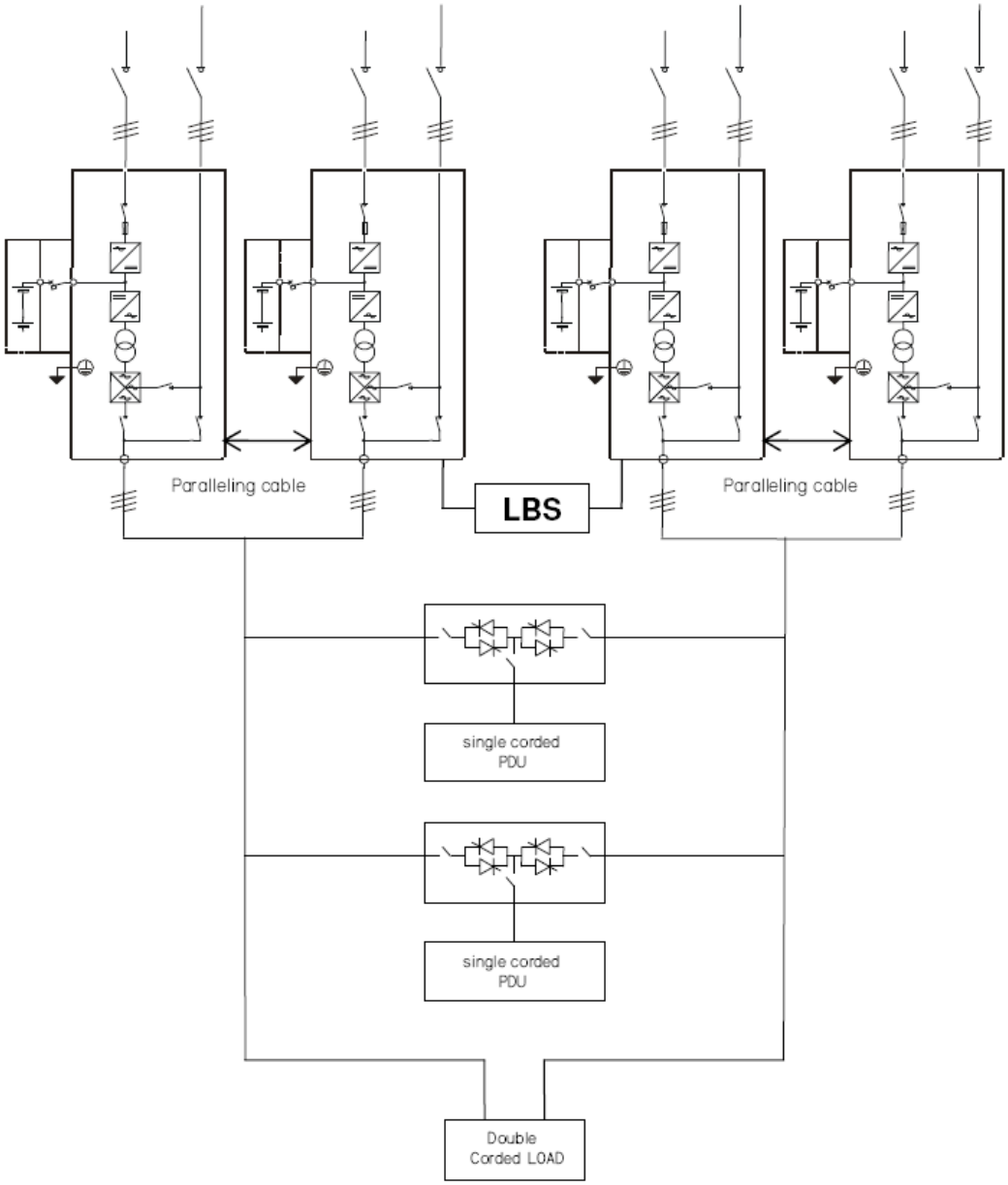


Fig.7- 7 Dual Bus System

Power Cables

The power cable connection of the dual-bus system is similar to that of the system with single UPS module. Refer to *Chapter 3 Electrical Installation*

Control Cables

7.3.4.1 Dual Bus Configuration of HIPULSE-NXL and HIPULSE-NXL

Refer to Figure 7-8 “Dual Bus System: Cable Connection of Single UPS Module”, and use the optional LBS cables to connect any two digital LBS interfaces that connect two UPS systems.

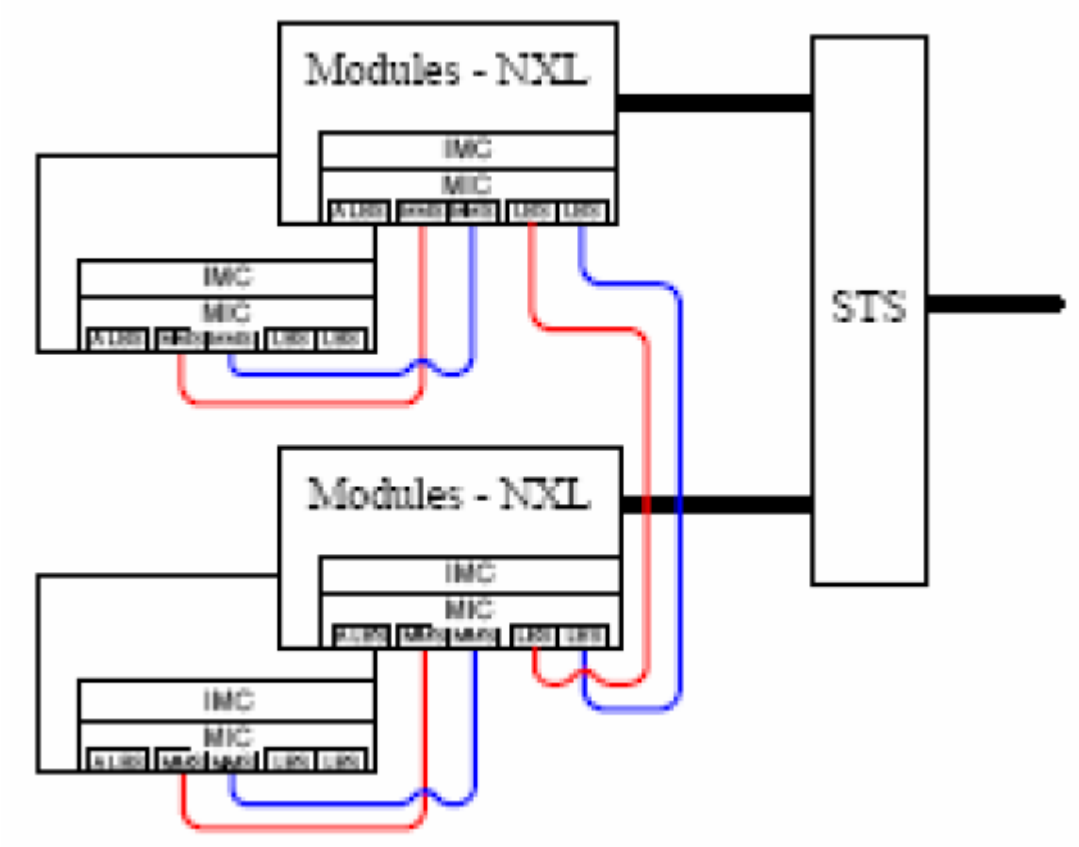


Fig.7- 8 Dual bus system: Cable connection of single UPS module

1. The capacity, voltage and frequency of two UPS systems must be the same.
2. The load cannot be larger than the rated capacity of single UPS system.

8. Specifications

This chapter provides the specifications of the HIPULSE-NXL 500/800kVA UPS.

Conformity And Standard

Table 8- 1 Conformity and standard

Description	Year	Normative references
Safety requirements	2005	IEC60950-1, IEC62040-1-1
EMC	2005	IEC/EN62040-2
Design and test methods	1999	IEC62040-3

Environmental Requirements

Table 8- 2 Environmental requirements

Item	Unit	Power rating	
		500kVA	800kVA
Operating Temperature	℃	0~40	0~35 (output PF: 0.9) 0~40 (output PF: 0.85)
Relative humidity	-	20℃At 20ºC, 5%~95%, no condenstation	
Altitude of operation	m	≤1500m, derated according to GB/T 3859.2-1993 for altitude higher than 1500m	
Storage temperature and transport temperature	℃	-25~70 (without battery)	

Mechanical Characteristics

Table 8- 3 HIPULSE-NXL 500/800kVA Mechanical characteristics

Item	Unit	Components				
		500kVA		*800kVA*		
		Rectifier cabinet	Inverter cabinet	Rectifier cabinet	Inverter cabinet	Switch cabinet
Height	mm	1950				
Width	mm	1250	1585	1585	1570	800
Depth	mm	1090				
Weight	kg	1750	1940	2850	3080	460
Ventilation	-	By internal intake fans				
Cable entry	-	Top or bottom of cabinet				

Note:
1. The volume (height/width/depth) and weight does not include the packaging materials.

UPS Electrical Characteristics (Input Rectifier)

Table 8- 4 Electrical characteristics (input rectifier)

Item	Unit	Power rating	
		500kVA	**800kVA**
Power rating	Vac	**380**/400/415 (line-to-line voltage)	
Supply	-	Three phase without neutral	
Input voltage tolerance [1]	%	380V system:-23%~+15%, 291V~438V (line-to-line voltage), recovery point (low limit: 352V high limit: 427V) 400V system:-25%~+15%, 300V~460V (line-to-line voltage), recovery point (low limit: 370V high limit: 450V) 415V system:-25%~+15%, 310V~477V (line-to-line voltage), recovery point (low limit: 385V high limit: 467V)	
Input harmonic current	-	<10% (No filter) <5% (with Trap filer) <3% (with Active filer)	
Power factor	-	≥0.8 (lag) (No filter) ≥0.89 (lag) (with Trap filer) ≥0.98 (lag) (with Active filer) Condition: Rated input voltage, output 100%KW	
Frequency	Hz	**50/60**	
Frequency	Hz	45~55(50Hz),54~66(60Hz)	
Rated input apparent power [2]	kVA	611	1086
Rated input current [2]	A	929	1650
Maximal input apparent Power [3]	kVA	754	1303
Maximal input current [3]	A	1145	1832
Duration of progressive power walk-in [4]	s	3～30	3～30
Note: 1. With mains at -20% and suggested number of cells the UPS can maintain the output rated voltage at rated load, and the battery does not discharge but cannot guarantee float charge to battery;. 2. IEC62040-3(5.2.2): UPS, rated load, input rated voltage 380V, no current to battery. 3. IEC62040-3(5.2.2): UPS, rated load, input rated voltage 380V, battery on boost charge with maximal allowed current. 4. Set by dedicated software installed in host computer			

UPS Electrical Characteristics (DC Intermediate Circuit)

Table 8- 5 Electrical characteristics (DC intermediate circuit)

Item	Unit	Power rating *(500/800kVA)*
DC bus voltage range	Vdc	490~566
Recommended number of lead-acid cells [1, 2]	PCS	228~246, Recommended number is 240
Float charge voltage	Vdc/Cell	2.15~2.3, Recommended value is 2.25
Boost charge voltage	Vdc/Cell	2.30~2.45, Recommended value is 2.35
End-of-discharge voltage	Vdc/Cell	1.60~1.88
Battery protectiion voltage 2.45 Vdc/Cell [1]	Vdc	588
Max boost charge duration [3]	h	200
Boost-float threshold current [3]	A	0.001C~0.025C
Ripple voltage [4]	%	≤1 (RMS value) ≤3.4 (Vpp value)

Item	Unit	Power rating *(500/800kVA)*
Note: 1. (According to rated voltage) 2. Different cells number and voltage per cell may be set by configuration software. 3. Set by software. 4. Battery disconnected, RMS percentage value referred to DC voltage		

UPS Electrical Characteristics (Inverter Output)

Table 8- 6 Electrical characteristics (inverter output)

Item	*Unit*	Power rating	
		500kVA	**800kVA**
Rated output voltage[1]	Vac	**380**/400/415	
Output supply	-	Three-phase four-wire, that is, with neutral	
Rated Power at cos = 0.9	kVA	500	800
Rated Power at cos = 1	kW	450	720
Three-phase overload time[2]	Min, I/In	60, 110% 10, 125% 1, 150%	
Maximal non linear load allowed[3]	-	100kVA	
Voltage stability, steady State test[2]	%	±1% (balanced load) ±2% (imbalance load)	
Voltage stability, transient test[4]	%	±5%RMS	
THD(linear load)[5]	%	2% (line-to-neutrl voltage)	
THD(non linear load)[3]	%	2.5% (line-to-neutrl voltage)	
THD(non linear load)	-	120±0.5° (balanced load) 120±1° (imbalance load)	
Frequency range	Hz	Synchronous status, track the bypass input, bypass synchronous window: 0.3Hz to 5Hz settable(0.1Hz step)	
Frequency slewrate[6]	Hz/s	0. 1Hz/s to 3Hz/s(settable, step: 0.1Hz/s)	
Bypass transfer time	ms	Inverter synchronizes with bypass, transfer time is 0; Inverter does not synchronize with bypass, transfer time is less than 20ms	
Battery transfer time	ms	0	
Note: 1. Factory set 380V, 400 or 415 voltages settable through software. 2. IEC62040-3 (5.3.2) 3. Reference non-linear load requirement specified by IEC62040-3(ANNEX E) 4. IEC62040-3(5.3.1), including 0~100~0% load transient, restore time 20 ms with resolution of 1% 5. Load is from 0 to 110% 6. Factory setting is 1 Hz/s, settable through software			

UPS Electrical Characteristics (Bypass Input)

Table 8- 7 Electrical characteristics (bypass input)

Item	Unit	Power rating *(800kVA)*								
Rated mains voltage *	Vac	**380**/400/415								
Supply	-	Three-phase four-wire, that is, with neutral								
Rated current 380 Vac 400 Vac 415 Vac	A	500kVA	800kVA							
		760	1216							
		722	1155							
		696	1113							
Bypass voltage tolerance	%	-20%~+15%								
Delay time to acknowledge returned to window	s	2								
Inverter output voltage window	%	±1								
Frequency	Hz	50/60								
Input frequency tolerance	%	±10								
Maximum frequency slew rate	Hz/s	3								
Current rating of neutral cable	-	1.1In								
Protection, bypass line	-	The bypass line should be protected using an external device in the input distribution system. This device should be sized for statisfying different load protection needs.								
Transient overload	ms	10	20	50	100	200	500	1000	2000	5000
	I/In	11.5	10.5	9.25	7.75	7.5	6.38	5.88	5.38	4.63
Note: Factory set 380V, 400 or 415 voltages settable through software.										

UPS Electrical Characteristics (System Performance)

Table 8- 8 Electrical characteristics (system performance)

Item	*Unit*	Power rating	
		500kVA	800kVA
No load losses	kW	9.5	14.9
Full load losses (100%)	kW	40.5	56.5

9. Service & Maintenance

Regular service and maintenance are required during the long term operation of the UPS system (including the associated battery). The battery maintenance has been described in chapter 6. This chapter deals with the life characteristics of the key components of the UPS, and provides recommendation for the regular check and service of the key components. Proper service and maintenance of the UPS system can extend the UPS life and reduce the risk of system malfunction.

Safety


WARNING

The daily patrol check of the UPS system can be conducted by trained personnel, while the check and replacement of the UPS components should be done by authorized professionals.

UPS Key Components And Their Lives

During the UPS operation, some UPS components' lives are shorter than the UPS life due to wear in working. To ensure the safe power supply of the UPS system, regular check and replacement of these components are required. This section introduces the key components of the HIPULSE-NXL 500/800kVA UPS and their reference working lives. For systems working in different conditions (environment, load, and so on), you may ask professionals to assess the components and provide advices whether to replace the components by referring to the information provided in this section.

Magnetic Components: Transformer, Inductor

The design life of the magnetic components is 20 years. The key factors affecting the life of the magnetic components are the insulation system and the temperature increase in operation. The HIPULSE-NXL 500/800kVA UPS adopts H-level insulation system and can withstand up to 220°C working temperature. Normally, the UPS works in forced air convection cooling condition.

Power Semiconductor Devices

The power semiconductor devices include SCR (silicon-controlled rectifier) and IGBT (insulated gate bipolar transistor). In normal UPS working condition, there is no rated life of the power semiconductor devices. The SCR and IGBT failures are always caused by other problems, as they do not have the problem of life expiration. However, in system service and maintenance, you should check on an annual basis the appearances of the power semiconductor devices for erosion and damage in package. If you spot any risk of failure, replace the device.

Electrolytic Capacitors

The life of the electrolytic capacitors depend on the DC bus voltage, ripple current and ambient temperature of the UPS.

To ensure safe and stable UPS operation, it is recommended to check the operation status of the electrolytic capacitors on an annual basis. The electrolytic capacitors must be replaced before their life expires, advisably, within 5 to 6 years of operation.

AC Capacitors

It is recommended to replace the AC capacitors within 5 to 6 years of continuous operation, and to check the AC capacitors on a half year basis. Replace the AC capacitor if spotting any deformation.

Dust Filter

The dust filter must be checked and replaced periodically. The checking and replacing interval is dependent on the environmental conditions of UPS. Under general environmental conditions, the dust filter should be cleaned or replaced every two months. If the environment has more dusts or is more severe, clean and replace dust filter more frequently even in a new building. The dust filter of NXL UPS is mounted on the front door of the cabinet and can be replaced when the UPS is operating.

Lives And Recommended Replacement Time Of Key Components

The key components listed in Table 8-1 are used in the UPS. To prevent system malfunction caused by failure of key components due to wear during working, you are recommended to check them regularly, and replace them within their life expectancy.

Table 9- 1 Lives and recommended replacement time of key components

Key components	Life expectancy	Recommended replacement time	Recommended check period
AC capacitor	≥7 years (~62, 000 hours)	5~6 years	6 months
Electrolytic capacitor	≥7 years (~62, 000 hours)	5~6 years	1 year
Fan	≥7 years (~62, 000 hours)	5~6 years	1 year
Dust filter	1~3 years	1~2 years	2 months
Valve-regulated lead-acid battery (5 years of life)	5 years	3~4 years	6 months
Valve-regulated lead-acid battery (10 years of life)	10 years	6~8 years	6 months

Replacing Fuses

When replacing the fuse on the high-voltage interface board or the fuse in the fuse box, use a fuse of the same model, avoid being misled by the parameter screen-print on the fuse box.In the systems, do not exchange the AC fuse with DC fuse.

Maintenance

Some routine maintenance works for UPS:

1. Keep good record. Good history record is helpful to solve some difficult problems.

2. Keep clean. Keep the UPS from dust and moisture.

3. Keep suitable ambient temperature, and the most suitable temperature is 20ºC to 25ºC. Too low temperature will reduce the battery capacity and too high temperature will reduce battery life.

4. Check connections. All the connection screws should be tightened and should be calibrated once a year.

5. Check periodically. Periodically check if there is any abnormal condition in the upstream and downstream of the UPS so as to cut the input or output when over current happens.

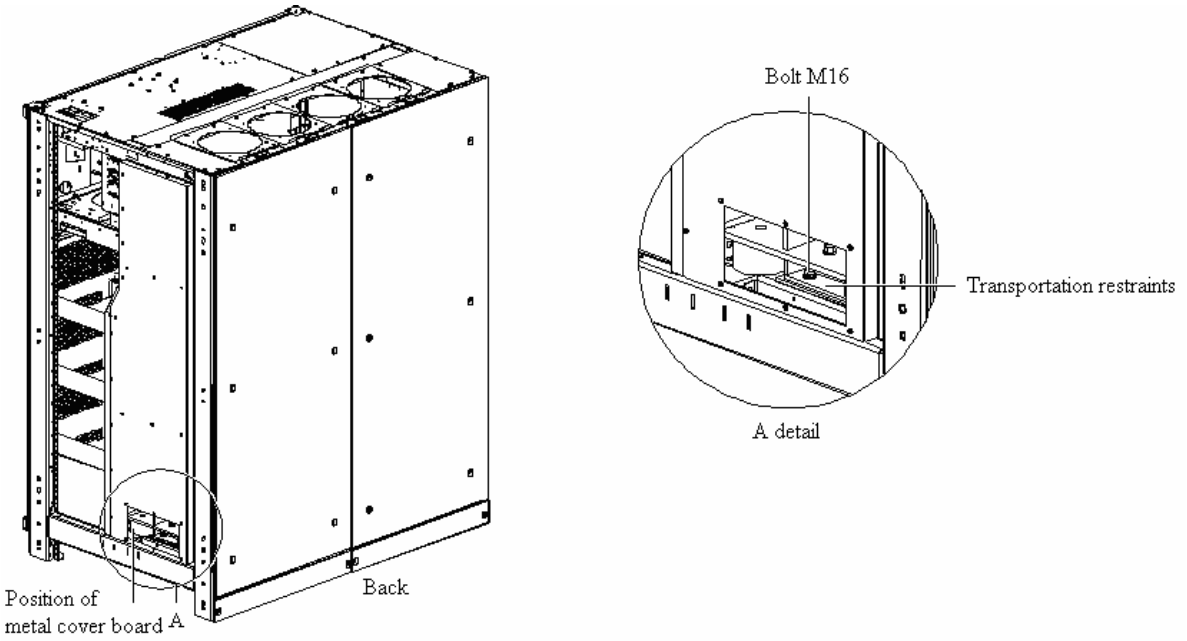
The maintenance engineer should be familiar with the typical environmental conditions of the UPS so as to find out which environmental condition is abnormal. He should also be familiar with the location of the UPS control and display panel.

For the battery maintenance, refer to *6.11 Battery Maintenance*

Appendix 1 Transportation Restraints Removing Procedures

1. Rectifier Input Transformer Transportation Restraints Removing Procedures

1. There is a small metallic cover at the left bottom part of the rectifier cabinet, remove this cover to expose the transportation restraints at the bottom part of the input transformer, as shown in Figure 1. Keep the removed screws.



Appendix- 1 Removing the input transformer transportation restraints

2. There is a transportation restraint respectively in the left and right sides at the bottom of the input transformer. First, remove the two M16 screws at the bottom part of the transportation restraint shown in Figure 1.

Note
Only remove the screw underneath the transportation restraint, the screw on the top of the transportation restraint needs not to be removed.

3. Remove the right cover of the rectifier cabinet to expose the metallic cover at the location as shown above. Keep the removed screws.

4. Remove the metallic cover to expose the transportation restraints on another side of the transformer. Keep the removed screws.

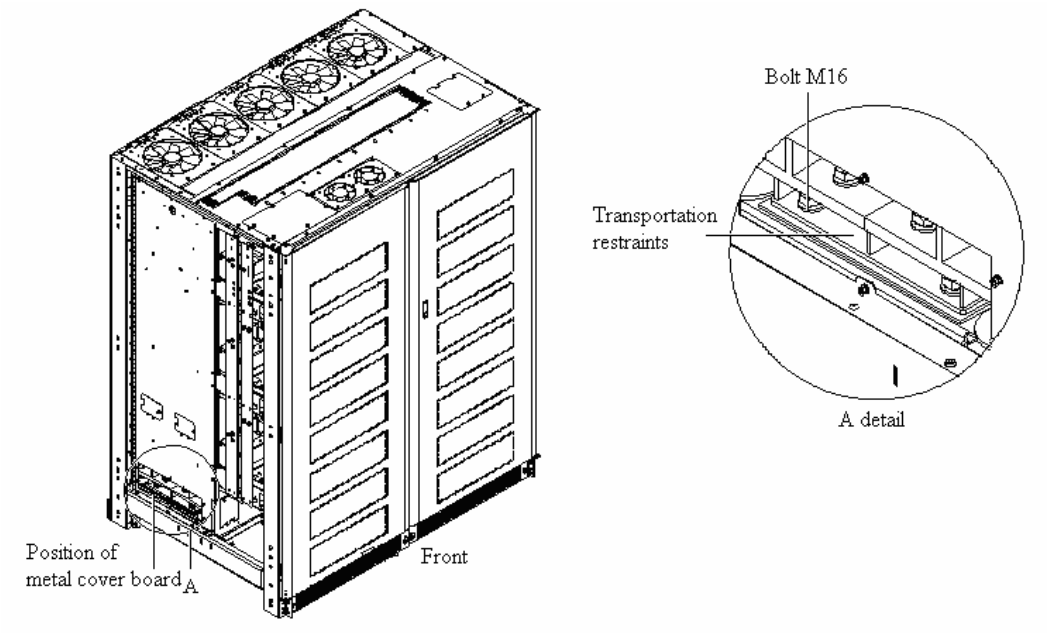
5. Remove the two M16 screws at the bottom part of the transportation restraint.

6. Re-install the metallic covers at two sides of the rectifier cabinet to their original positions.

7. Re-install the right panel of the rectifier cabinet to its original position. Execute this step after equipment commissioning is completed.

2. Inverter Output Transformer Transportation Restraints Removing Procedures

1. There is a small metallic cover at the left bottom part of the inverter cabinet, remove this cover to expose the transportation restraints at the bottom part of the input transformer, as shown in Figure 2. Keep the removed screws.



Appendix- 2 Removing the output transformer transportation restraints

2. There is a transportation restraint respectively in the two sides at the bottom of the output transformer. First, remove the two M16 screws at the bottom part of the transportation restraint shown in Figure 2.

Note
Only remove the screw underneath the transportation restraint, the screw on the top of the transportation restraint needs not to be removed.

3. Remove the metallic cover at the right bottom part (in the same location as described above) of the inverter cabinet to expose the transportation restraints at another side of the transformer. Keep the removed screws.

Note: On the left side of the metallic cover, there is a metallic base plate of a discharging resistor (for bus capacitor), and this plate blocks the metallic cover. Move this plate 30 cm to the left and then remove the metallic cover.

4. Remove the two M16 screws at the bottom part of the transportation restraint.

5. Re-install the metallic covers at two sides of the Inverter cabinet to their original positions, and move the metallic base plate of the discharging resistor to its original position.

Appendix 2 : Hazardous Substances or Elements Announcement

Parts	Hazardous Substances					
	Plumbum	Hydrargyru	Cadmium	Chrome^{6+}	PBB	PBDE
	Pb	*Hg*	*Cd*	*Cr^{6+}*	*PBB*	*PBDE*
Cabinet/ Enclosure / Copper busbar	○	○	○	○	○	○
Metallic parts / fixing parts	○	○	○	○	○	○
Plastic parts	○	○	○	○	○	○
Heatsink	○	○	○	○	○	○
PCBA	×	○	○	○	○	○
AC capcitor	○	○	○	○	○	○
DC capacitor	○	○	○	○	○	○
Fan	○	○	○	○	○	○
Cables	×	○	○	○	○	○
LCD	○	○	○	○	○	○
Sensors	×	○	○	○	○	○
Large-medium power magnetic components	○	○	○	○	○	○
Distribution switches (circuit breaker / contactor)	○	○	○	○	○	○
Fuse	○	○	○	○	○	○
Contactor (when applicable)	○	○	○	○	○	○
Semiconductors	○	○	○	○	○	○

○: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006

×: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006

Emerson Network Power Co., Ltd. has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the harzardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain harzardous substances due to the lack of reliable substitute or mature solution:

1. All solders in the products contain plumbum
2. Copper alloy contains plumbum
3. Backlight bulb contains Hydrargyrum

About Environment Protection Period: The Environment Protection Period of the product is marked on the product. Under normal working condtions and normal use of the products observing relevant safety precautions, the hazardous substances in the product will not seriously affect the environment, personnel safety or property in the Environment Protection Period starting from the manufacturing date.

Applicable product:Liebert HIPULSE-NXL 500/800kVA